



Tottington Print Works, Tottington, Bury Greater Manchester

Archaeological Investigation



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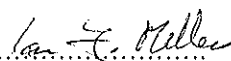
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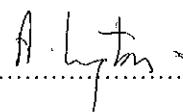
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SUMMARY

In February 2011, Oxford Archaeology North (OA North) was commissioned by Bury Council to carry out historical research and an archaeological survey of Tottington Mill, a former industrial site in the Kirklees Valley near Tottington, Bury (centred on NGR SD 77985 13662). The work was prompted by the Environment Agency, which is required by a European directive to ‘naturalise’ watercourses by removing man-made obstructions wherever possible. One such obstruction has been identified in the Kirklees Valley, where the flow of the Kirklees Brook is impeded as it passes through a stone-built culvert at the site of Tottington Mill.

The site of Tottington Mill is of considerable historical and archaeological interest, having been used since at least the thirteenth century by water-powered industries. A corn mill at Tottington is referred to in documents dating back to 1296, and whilst the precise location of this mill remains uncertain, it is likely to have stood within the present study area. In 1790, a four-storey cotton-spinning mill was erected on the site, which remained in operation until *c* 1819. In 1820, the site was purchased by Joshua Knowles, and converted for use as a calico-printing works. The business passed to Samuel Knowles in 1854, and amalgamated with the Calico Printers’ Association in 1899, but remained in operation as a textile-printing works until 1927. The majority of the buildings were demolished during the early 1930s, although the engravers’ shop continued in use until the 1940s, after which it was demolished.

In order to secure archaeological interests, the County Archaeologist for Greater Manchester, who provides advice to Bury Council on archaeological matters, has recommended that a programme of appropriate investigation is carried out to inform and support the Environment Agency’s proposal. In addition, Bury Council, as the landowner, is keen to establish a better understanding of the extensive structural remains of the print works that survive on the site. In order to investigate these remains further, Bury Council funded an extension to the archaeological investigation required in support of the Environment Agency’s proposal to incorporate the entire footprint of the print works. The scope of the recommended scheme of works comprised a measured survey of the above-ground structural remains, coupled with a programme of documentary research and intrusive investigation that actively engaged members of the local community. In addition, an assessment of the archaeological significance of the site was required, coupled with a consideration of the impact of the Environment Agency’s proposal to remove the culvert.

The intrusive investigation was targeted on two areas of the site, and exposed extensive and well-preserved structural remains of the print works. Coupled with the wealth of documentary material available, the investigation has enabled the compilation of an in-depth account of the print works, the remains of which are undoubtedly of considerable archaeological importance. It has also provided a good indication of the depth, extent and nature of the buried archaeological remains that survive across the site, allowing the potential impact of the Environment Agency’s proposal to be gauged.

An assessment of the Environment Agency's proposal has concluded that implementation of the scheme to remove the culvert that runs through the centre of the print works would have a substantial negative impact on the heritage of this important site. This would require a robust programme of archaeological mitigation, which is likely to involve an archaeological excavation along the route of the culvert to enable a detailed record of the surfaces and surviving historic fixtures and fittings within the Dye House to be compiled. In addition, once the overlying structures had been recorded fully, the removal of the culvert is likely to require archaeological monitoring to enable the fabric of the culvert to be examined. In particular, the side walls of the culvert may retain important evidence for earlier structures, potentially associated with the documented corn mill and eighteenth-century cotton mill. Consideration would also needed to be afforded to the consolidation of these walls, which act as retaining walls for the floor surface in the Dye House, to ensure that there was no subsequent loss of historic structures through erosion or slumping.

The project has been enormously successful in its involvement of the local community, eliciting a huge level of interest and support. The fieldwork carried out has demonstrated that there is significant potential for further community-based archaeological investigation at the site, whilst the preservation and character of the surviving remains present a valuable opportunity for the consolidation, interpretation and display as an important monument to the industrial heritage of the area. It is suggested that the site demonstrably merits consideration for the award of a substantial funding package from a body such as the Heritage Lottery Fund to enable the worthy heritage aspirations of the site to be achieved.

ACKNOWLEDGEMENTS

Oxford Archaeology North (OA North) would like to thank David Dutton and Chris Wilkinson for commissioning and supporting the project on behalf of Bury Council, which provided a significant element of the funding required. Special thanks are expressed to Paul Robinson, the Local Nature Reserves Officer for Bury Council, for his unfaltering support and direction in facilitating the volunteer groups. OA North is also grateful to Norman Redhead, the County Archaeologist for Greater Manchester, and Mick Nightingale, the Conservation Officer for Bury Council, for their advice, guidance and support. Thanks are also expressed to James Burbidge of Bury Council for providing a photographic record of one of the public open days. OA North is also grateful to Lee Beveridge and Gary Morris of the Environment Agency for making available records obtained from their trial investigations of the site.

The clearance and excavation works were carried out by scores of volunteers from the local community, too numerous to mention individually, who attended several organised events. Significant input to these events was provided by a group from the British Trust for Conservation Volunteers (BTCV), led by Gary Piggott, and volunteers with the Bury Rangers, led by Anna Cocker, who are all gratefully acknowledged. Special thanks are expressed to Christine Taylor for her assistance with sourcing documentary material, Russell James Binns for donating a collection of chance artefacts, the Reverend Andrew Lonsdale at Greenmount United Reformed Church, the Friends of the Kirklees Valley Group, the Tottington District Civic Society, members of the Ramsbottom Heritage Society, and the Holcombe Moor Heritage Group.

The survey was undertaken by Chris Wild, Graham Mottershead and Ian Miller, who also supervised the excavations carried out by local volunteers. The documentary research was carried out by Ian Miller, and the illustrations included in the report were prepared by Mark Tidmarsh. The finds were examined by Jeremy Bradley, and the report was compiled by Ian Miller, who was also responsible for project management.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF THE PROJECT

- 1.1.1 A stone-built culvert that channels the Kirklees Brook through the centre of the site of Tottington Print Works in the Kirklees Valley is presently impeding the flow of water during periods of high rainfall. In order to redress this issue, and in accordance with a European directive to ‘naturalise’ watercourses, the Environment Agency is considering an option to remove the culvert, although it also needed to establish whether there were either any contaminated land or archaeological constraints prior to formulating a firm proposal. The culvert originally formed an integral element of the water-management system for a nineteenth-century calico print works, although it is possible that it was built on the site of a manorial corn mill, which is referred to in documents dating back to 1296. In particular, the location of the culvert may indicate where the waterwheel for the medieval corn mill had been sited.
- 1.1.2 In order to secure archaeological interests, the County Archaeologist for Greater Manchester, who provides advice to Bury Council on archaeological matters, recommended that a programme of research, survey, excavation and assessment was carried out in conjunction with the Environment Agency’s initial intrusive investigation of the site to establish the levels of contamination. In addition, Bury Council, as the landowner, was keen to establish a better understanding of the extensive structural remains of the former print works that survive on either side of the Kirklees Brook around the culvert. These remains include stone-built cisterns, the foundation beds for machinery, sluice mechanisms, retaining walls and wall foundations, which are all visible in the woodland environment of the site. In order to investigate these remains further, Bury Council funded an extension to the archaeological investigation required in support of the Environment Agency’s proposal to incorporate the entire footprint of the former print works.
- 1.1.3 The scope for an appropriate scheme of archaeological investigation to cover the Environment Agency’s requirements and Bury Council’s aspirations was devised by the County Archaeologist for Greater Manchester, and presented in a Project Brief (*Appendix 1*). In February 2011, Oxford Archaeology North (OA North) was commissioned by Bury Council to carry out the recommended programme of archaeological work. This comprised an archaeological survey and assessment of the above-ground remains of the mill complex, coupled with a comprehensive review of the available documentary material, and an assessment of the results obtained from a series of trial holes that were excavated across the route of the culvert by the Environment Agency in February 2011. The project also aimed to engage the local community in a limited programme of excavation of the wider site, which was intended to provide an understanding of the depth, extent and significance of any buried remains of archaeological interest. It was also intended that the work would raise the profile of the site locally, and inform a strategy for the long-term management of the remains.

1.2 LOCATION, TOPOGRAPHY AND GEOLOGY

- 1.2.1 The site of Tottington Print Works (centred on NGR SD 77985 13662) is situated beside the Kirklees Brook within the Kirklees Valley Local Nature Reserve, and is bounded by Shepherd Street, Brandlesholme Road and Kirklees Street (Plate 1). It lies some 0.8km to the north-east of Tottington, and 3.5km north-west of Bury town centre, in the northern part of Greater Manchester (Fig 1).



Plate 1: Recent aerial view of the study area, looking west

- 1.2.2 The Kirklees Brook is a fast-flowing tributary of the River Irwell. It rises north of Hawkshaw and flows south-eastwards to Two Brooks, and then south to continue west of Holly Mount. It then turns east, and flows beneath Ramsbottom Road at Brook House Bridge, before turning south-east and continuing to Stormer Hill Works and then due east towards Island Lodge. The study area lies astride a meander in the brook, which continues southwards to Kirklees and Woolfold, and then south-eastwards to its confluence with the River Irwell at Bury Ground, on the western fringe of Bury.
- 1.2.3 The underlying solid geology is Lower Westphalian coal measures of the Carboniferous era, which provided a major contribution to the early industrial exploitation of the area (Ordnance Survey 1951). The surrounding hills are generally formed of Carboniferous sandstones, ranging from the more recent Accrington mudstones to older gritstones and other formations, such as Dyneley Flag and Dandy Rock. The former were used locally for flagstones and roofing before the introduction of Welsh slate, and later for brick-making, whilst the latter were used widely in the locality for providing stone setts and kerbstones. The drift cover consists primarily of soils of the Brickfield Association, being medium- to fine-textured tills derived from the Carboniferous sandstones (Countryside Commission 1998, 102).

2. METHODOLOGY

2.1 ARCHAEOLOGICAL SURVEY

- 2.1.1 The archaeological survey was broadly consistent with a Level I/II-type survey (English Heritage 2006), and comprised a written record, combined with measured drawings and a detailed photographic record.
- 2.1.2 **Descriptive Record:** written records using OA North *pro-forma* record sheets were made of all principal building elements, in addition to any features of historical, archaeological or architectural significance. Particular attention was made to the relationship between the various parts of the buildings, especially those that could allude to their chronological development.
- 2.1.3 **Instrument Survey:** a plan of the building remains was surveyed with a reflectorless electronic distance measurer (REDM). The plan was produced in order to illustrate the form, phasing and development of the buildings. Features of historical, structural and archaeological significance were annotated on to the drawings. An industry standard CAD package was used to produce the final drawings.
- 2.1.4 **Photographic Survey:** photography was undertaken using 35mm cameras on archivable black and white print film, as well as with a high-resolution digital SLR camera. The photographic archive consists of both general site views and detailed photographs of features of particular interest.

2.2 EXCAVATION

- 2.2.1 Parts of the site were targeted for archaeological excavation by volunteer groups and members of the local community, under the direction and supervision of OA North. Excavation was focused on two parts of the print works, situated on either side of the track through the site.
- 2.2.2 All information identified in the course of the site works was recorded stratigraphically, using a system adapted from that used by the Centre for Archaeology Service of English Heritage. Information was recorded on *pro-forma* record sheets, and was accompanied with sufficient pictorial record (plans, sections and photographs) to identify and illustrate individual features.

2.3 FINDS

- 2.3.1 Finds' recovery and sampling programmes were carried out in accordance with best practice (following current Institute for Archaeologists guidelines), and subject to expert advice in order to minimise deterioration. All artefacts recovered from the excavation were examined, and a representative sample was retained.

2.4 ARCHIVE

- 2.4.1 The results of all archaeological work carried out will form the basis for a full archive to professional standards, in accordance with current English Heritage guidelines (*Management of Archaeological Projects*, 2nd edition, 1991). The original record archive of the project will be deposited with Bury Museum.
- 2.4.2 The Arts and Humanities Data Service (AHDS) online database *Online Access to Index of Archaeological Investigations* (OASIS) will be completed as part of the archiving phase of the project.

2.5 ARCHAEOLOGICAL ASSESSMENT

- 2.5.1 The principal objective of the archaeological assessment was to provide an understanding of the relative significance of the culvert that carries the Kirklees Brook across the site of Tottington Print Works. The assessment was intended to allow an informed decision to be taken with regard to the future of the culvert, and also assist the formulation of a strategy for the long-term management of the wider site. This was achieved by carrying out desk-based research coupled with a measured survey and limited excavation of the site.
- 2.5.2 When applied to an historic structure, the term ‘significance’ can be taken to have several definitions. The first is importance, suggesting that there is something about the site that is valuable, has status and should not be ignored. A site may be important because it is a rare survival, or the earliest known example of its type. It may represent a benchmark in terms of the application of technological development, or be a typical example of such sites. The level to which a site has remained intact is also an important factor in determining its value. The next is the idea of conveying meaning, implying that the site is a source of knowledge. Finally, there is the concept of a sign, that the structure is symbolic, and acts as a pointer to something beyond itself. The significance of any site is to a large extent embodied in its surviving fabric, which can retain evidence for how it developed and was adapted over time.
- 2.5.3 It is necessary to define what it is that gives significance to a site and therefore warrants protection. The culvert and the associated remains of Tottington Print Works encompass layers of archaeological and historical development, which may be valued for different reasons by different people, all of which should be taken into account in determining the overall significance. In their *Conservation Principles Policies and Guidance*, English Heritage have identified four areas of heritage values, which will be considered in determining the overall significance of the culvert and the wider site (English Heritage 2008):
- **Evidential:** this derives from the potential of a place to yield evidence about past human activity. This includes physical remains as the primary source of evidence and the people and cultures that made them. Significantly, where there is a lack of written records the importance of the material record increases;

- **Historical:** this originates from the ways in which past people, events and aspects of life can be connected through a place to the present. This may include illustrative value, such as its connection to an important development, such as technology, or associative value, such as the connection to an important event or person;
- **Aesthetic:** this is derived from the ways in which people draw sensory and intellectual stimulation from a place or building. These may be related to the design of a place, for example, through defensive reasons, or the informal development over time, such as the relationship of structures to their setting;
- **Communal:** this derives from the meaning of a place for the people who relate to it, and includes commemorative, symbolic, social and spiritual value. For example, some places may be important for reminding us of uncomfortable events in national history.

2.5.4 In determining the value of the culvert and the associated remains of Tottington Print Works as a heritage asset, it is also useful to refer to the Secretary of State's criteria for assessing the national importance of monuments, as contained in *Annexe 1* of the policy statement on Scheduled Monuments produced by the Department of Culture, Media, and Sport (2010). These criteria relate to period, rarity, documentation, group value, survival/condition, fragility/vulnerability, diversity, and potential.

3. HISTORICAL AND TECHNOLOGICAL BACKGROUND

3.1 HISTORICAL BACKGROUND

- 3.1.1 The following section presents a summary of the chronological development of Tottington Print Works. This is preceded by an historical overview of Tottington, and a summary of the calico-printing and bleaching industry, which is intended to place the site in its technological context.
- 3.1.2 **Early history:** physical evidence for human activity during the prehistoric period in the North West is sporadic, and based largely on chance finds of artefacts. Nevertheless, there is an increasing body of evidence to suggest that prehistoric activity in the region was focused on light, well-drained sands, especially those close to watercourses, rather than the glacial boulder clays that characterise the drift geology across much of the North West. However, evidence for the earliest human activity in the Bury area is recorded mainly from the higher ground above the Irwell Valley (Nevell and Redhead 1999). These upland areas appear to have been occupied in the summer months by hunter-gatherers, who took shelter in the valley bottom in the winter. During these months, it seems likely that they lived in small camps, such as that discovered by excavation on the Ee's in Radcliffe, from where artefacts of Mesolithic and Neolithic date have been recovered (Spencer 1951).
- 3.1.3 The earliest indication of more permanent settlement in the area dates to the Bronze Age, when small farming communities became established across the North West. In 1960-5, the remains of more than a dozen Bronze Age cremation burials were discovered during excavations at Whitelow Hill, near Ramsbottom (Nevell and Redhead 1999). Fragments of urns and other artefacts of a Bronze Age date have also been discovered within Bury (Miller and Gregory 2010).
- 3.1.4 Physical evidence for Iron Age activity in the area is provided by a defended settlement found just north of Bury at Castlesteads (Fletcher 1992). Pollen data from the various wetland areas also show widespread forest clearance during the Iron Age, which seems to indicate an increase in arable activity, and an expansion into both lowland and upland areas (Hall *et al* 1995). However, there is only tentative evidence for any prehistoric activity around Tottington; two fields off Longsight Road in Greenmount are named 'Great Crook' and 'Little Crook' in 1838 and 1794 respectively, which may be derived from the Old Welsh 'cruc' for hill/barrow, suggesting a Bronze Age funerary site (SMR 8694.1.0).
- 3.1.5 There is similarly a paucity of physical remains from the Roman period around Tottington. The Roman military is known to have arrived in the North West in the early AD70s, and built several forts connected by a network of roads across the region (Margary 1973). One of these roads crossed the River Irwell to the west of Bury, taking a route through Affetside, whilst a hoard of Roman coins has been discovered close to the line of this road at Ainsworth.

- 3.1.6 **Medieval Tottington:** physical remains of the period immediately following the Roman military occupation are rare in the North West, and much evidence is based on place-names, topographical elements such as curvilinear churchyards, and surviving stonework, including cross fragments and architectural detailing in buildings (Newman 1996). Amongst the few finds from the area dating to the early medieval period are an eight-century silver coin found at Whitelow, and fragments of an Anglian stone cross that had been reused in a wall close to Prestwich parish church (Miller and Gregory 2010). The name Tottington may be derived from the Old English, and could be translated as meaning the ‘tun’ or settlement associated with Totta, a common personal name (Mills 1976, 141). However, the precise location of any such settlement is uncertain, and physical evidence for activity during this period is lacking.
- 3.1.7 Following the Norman Conquest of 1066, the township of Tottington Lower End formed part of the De Lacy’s feudal Manor of Tottington, which ‘stretched about five miles on the banks of the Irwell, and far up the sides of the adjoining hills, from Elton to the great opening into Whalley parish’ (Nichols and Lyons (eds) 1872, 327). When the township was divided in *c* 1600, Tottington became one of several small hamlets that lay within the boundaries of the Lower End (Coupe 1977, 95).
- 3.1.8 **Tottington Corn Mill:** a manorial corn mill in Tottington is mentioned in a document dating to 1296. This is likely to be the same corn mill present on the site during the sixteenth century and associated with the name ‘Longley’, which may be the ‘Long Field’ shown on the tithe map of 1842 bordering the nineteenth-century print works (Farrer 1897). This is one of several field names concentrated in the area that can be related to medieval names, such as ‘Furlong Field’ (Lavan 1994).
- 3.1.9 In the sixteenth century, the manor of Bury was awarded to Lord Stanley, Earl of Derby, and the two corn mills that existed in Tottington at that time were passed to Greenhalgh of Brandlesholme (Coupe 1987, 3). Greenhalgh retained ownership of the mills, together with lands adjoining Kirklees Brook with the water rights, until 1653, when his estates were confiscated by the Commonwealth as a punishment for his support of the Royalist cause during the Civil Wars (*op cit*, 10). However, Greenhalgh did recover elements of his former estate subsequently, including Tottington Mill.
- 3.1.10 It seems that Tottington Mill was owned by Henry Wood by the early eighteenth century. During this period, Henry Wood and his son Thomas established a thriving fustian manufactory at Mill House (Coupe 1987, 17). In *c* 1719, the Woods had built a new house on their Mill House estate, which became known as Little Mill House. In 1727, Henry Wood brought an official enquiry to the Manor Court, which challenged the feudal rights of Tottington Mill. Known as the ‘lord’s mill’, the mill had the sole right to grind all corn grown in the village, for which a fee had to be paid to the lord’s bailiff (Henry Greenhalgh). No decision was actually reached, although Greenhalgh stated that he had no real interest in collecting the fee (Coupe 1977, 101). Whilst Henry Wood owned the corn mill, it seems that it was sub-let to a tenant called Lomax.

- 3.1.11 The earliest published map to show the position of the corn mill is William Yates' *Map of the County Palatine of Lancaster*, which was surveyed in 1775-80 and printed in 1786 (Plate 2). This depicts a water-powered mill on the site of the nineteenth-century print works, together with a mill pond that was enlarged subsequently to create Island Lodge.

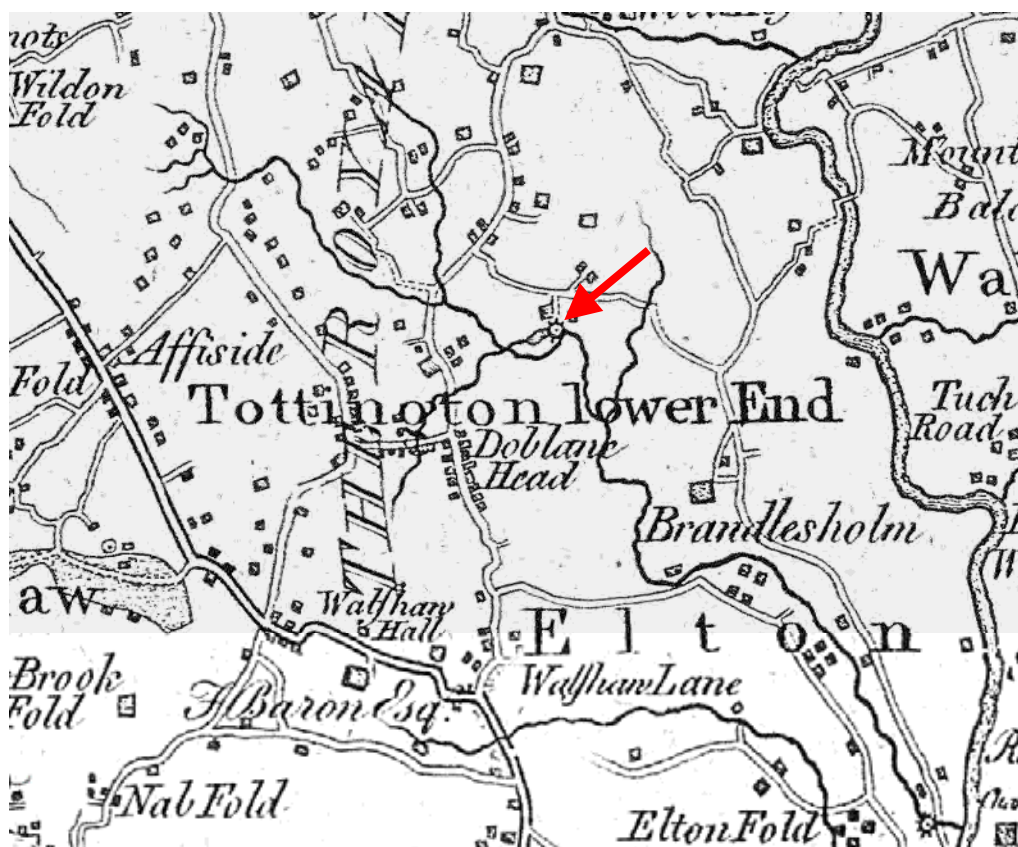


Plate 2: Extract from Yates' 'Map of the County Palatine of Lancaster', published in 1786

- 3.1.12 According to the details provided by a survey of Tottington Lower End that was compiled in 1794, Tottington corn mill was still tenanted by William Lomax, and comprised 'one mill building, smithy, etc'; Lomax is also described as a shuttle maker, reflecting the importance of the textile industry to the economy of the area. Thomas Wood still owned the Mill House, and was described as a fustian manufacturer and tanner (Smith *et al* 1794, 44). The value of the corn mill is given as £16, whilst Mill House was valued at £31 (*op cit*, 83).
- 3.1.13 The survey of 1794 also indicates that Shepherd Lane, including two cottages and a house, belonged to John Leigh. Leigh is also listed as the owner of 'Tottington mill factory and other premises', which comprised factory buildings occupied by John Leigh (Section 3.2.4 below), and six cottages occupied by James Hurst, Thomas Lever, Mary Duckworth, John Williams, John Barns and Alice Barns. Leigh's property also included waste land known as Kiln Hill. The survey also list five loomshops, 11 warehouses, and four factory buildings in Tottington Lower End, and notes that a large proportion of the population was engaged as handloom weavers (*op cit*, 43). The total value of John Leigh's mill factory is given as £41, whilst his properties on Shepherd Lane were valued at £16.

3.2 BACKGROUND TO THE TEXTILE INDUSTRY AND TOTTINGTON COTTON MILL

- 3.2.1 The manufacture of woollen cloth was an important industry in Bury throughout the medieval period. Consequently, it had grown at the centre of a dense web of manufacturing towns and villages. The domestic textile industry benefited greatly from the ready supplies of waterpower for small-scale workings and also the humid atmosphere, which meant thread was less likely to break (Aspin 1995). However, in the latter part of the eighteenth century a number of the established textile firms of Bury, which had previously carried out woollen manufacture, began to convert on a wholesale basis to cotton, using the waterpower of the rivers Roch, Irwell, and their tributaries. The beginning of the rise of the cotton industry in Bury can be traced to 1773, when the Peel family and William Yates established Brooksbottom Mill calico-printing works at the boundary of the Irwell between Bury and Elton (Gray 1970, 62). This was coupled with an expansion of the bleaching trade.
- 3.2.2 After the mid-eighteenth century, the new ‘crofting’ method for bleaching woven cloth provided a new use for redundant sheep-grazing land on the bleak and infertile moorland in the area. The 1794 survey identifies 66 crofts in Tottington Lower End, which included bleachgrounds owned by some of the largest firms in the country, such as Robert Peel and Livesey & Hargreaves of Walton-le-dale (Smith *et al* 1794). Moorland smallholdings became increasingly attractive to speculators and city manufacturers, as they offered profitable accommodation for imported labour to engage in manufacturing textile goods. Within a century, many of the estates of the landed gentry had been sold piecemeal for various industrial purposes (Coupe 1977, 95).
- 3.2.3 By the end of the eighteenth century, and stimulated by the ending of feudal water rights in 1794, several cotton-spinning mills had been established in Tottington Lower End and along the Kirklees Brook. Most of these were small water-powered spinning mills with their own weirs, leats and lodges (UMAU 1996). The new cotton mills in Tottington Lower End included those established at Stormer Hill, Kirklees, Throstle Grove, Wool Fold and Croston Clough, which were all packed very tightly along the Kirklees Brook in order to maximise the use of the available water. It was also during this period that Tottington Mill was established on the Kirklees Brook.
- 3.2.4 **Tottington Cotton Mill:** on 26 June 1790, Richard Powell of Manchester and his brother, Samuel, of Liverpool, leased for 999 years at £26 yearly rent Tottington Lower Mill to John Leigh, a merchant of Bolton. The mill is described as ‘that ancient water corn mill...commonly called Tottington Lower Mill and the kiln belonging and the land adjoining...’ (LRO DDSL 2/11/22). Richard and Samuel Powell also agreed to surrender to Leigh ‘a copyhold messuage and tenement called Shepherds’, together with more than four acres of adjoining land, and the right to take down existing buildings and to erect others ‘more substantial’ (*ibid*). Leigh, in partnership with two London merchants, John Haslam and Thomas Kinder, immediately erected a new four-storey mill for spinning cotton. The new mill measured some 76 x 32ft, and was powered by a 22ft waterwheel that was 3ft 4in wide (Aspin 2003, 261). The partners also erected a new corn mill on the site, together with a smithy, seven cottages, a large house, a warehouse, a barn and stables.

- 3.2.5 In 1791, Leigh insured the mill with the Royal Exchange Assurance Company for £1,000, and its contents for a similar amount. He also insured the barn for £400 (*ibid*). A second policy was taken out in June 1792, which valued the mill as £1,500, its machinery at £800 and utensils at £800. The new 'water corn mill house nearby with going gears and machinery' was valued at a similar figure. By 1796, John Leigh had passed his business onto his son, John Escrick Leigh, who was declared bankrupt in October of that year.
- 3.2.6 It seems that the mill was taken over subsequently by Thomas Leaver, who is listed in trade directories from 1797 to 1802 as a 'manufacturer of muslin, dimity, etc' at Tottington Mill (Scholes 1797, 153; Bancks 1800, 107; Bancks 1802, 106). It is unclear who took Tottington Mill subsequently, although James Moreton is listed as a manufacturer of dimity, quilting, etc at Tottington in a trade directory for 1804 (Dean & Co 1804, 204).
- 3.2.7 The mill was put up for sale in 1810, a notice in the *Manchester Chronicle* stating that it was powered by a waterwheel measuring 27 x 7ft, which was 'constantly supplied with water sufficient to work a large quantity of machinery, except in very dry seasons'. The advertisement goes on to say that the owners had completed a building 'for setting up a steam engine', implying that an engine had not actually been installed at that date (Aspin 2003, 261). A plan of the area was produced in the same year (UMAU 1996), although this cannot now be traced.
- 3.2.8 In 1811, Samuel Crompton compiled the number of cotton-spinning spindles in operation in his 'census' of 1811. The number of spindles recorded at individual mills is indicative of small premises attached to the whole manufacturing works. The largest of these pioneering spinning mills in the township was that owned by Gorton at Kirklees, which housed 9,284 mule spindles, which may be the equivalent of 23 spinning mules. Other cotton spinners at Tottington Lower End included James Rothwell at Bottoms Hall (740 throstles), Parker at Cinder Hill (650 mules and 1728 jennies), Hall at Quarlton (3280 mule spindles), Potter at Fernswood (688 mule spindles), and Rostron at Holcombe (5520 mule spindles). However, Crompton did not include any entries that can be associated firmly with Tottington Mill, suggesting that it may not have been in operation in 1811.
- 3.2.9 The cotton mill was offered for sale again in 1819, the advertisement noting that a 10hp steam engine had been installed at the mill (Aspin 2003, 261). It was purchased eventually in 1820 by Joshua Knowles, who converted the mill for use as a calico-printing works (Graham 1846, 435). This was a popular trend and, by the 1830s, many of the mills in the Kirklees Valley had been converted to calico printing and bleaching as the Irwell catchment developed rapidly as a leading centre for the textile finishing trades. Indeed, during the eighteenth and nineteenth centuries, some 37 bleach works, 33 dye works and 15 print works were established within the boundary of the modern metropolitan borough of Bury, representing an important concentration of textile-finishing works (McNeil and Nevell 2000, 24).

3.3 BACKGROUND TO THE CALICO-PRINTING INDUSTRY

- 3.3.1 Calico printing is a term applied generically to the printing of any textiles, although it originated to describe specifically the printing of cotton cloth (Murphy 1911, 2). The first printed cotton cloth, known as chintz, was introduced into England from India during the seventeenth century. At that time, clothes in Britain were made from wool, linen, or silk, and plain dyed with natural colours. Indian chintz was very fine cotton, brightly coloured with exotic patterns (O'Brien 1792). It quickly became fashionable and English printers, based primarily in London, began to manufacture copies (Chapman and Chassagne 1981). The popularity of the Indian chintzes, and the English copies, alarmed the established wool and silk manufacturers, who successfully lobbied parliament for legislation to protect their trade; the use of Indian chintz was prohibited by law in 1701, whilst a further Act of Parliament in 1721 banned the use of all printed, painted or dyed calicos (Turnbull 1951). In Lancashire, weavers produced an alternative cloth, with a linen warp and cotton weft known as fustian (Aspin 1995). This was exempt from the law, and dyers and printers found ways of copying the Indian chintz using fustian. When public demand led to the regulations against cotton cloth being removed, British printers and dyers were able to produce their own chintz. This quickly became more popular than the imported material.
- 3.3.2 The oldest method of printing was block printing, which employed engraved wooden blocks in a similar manner to reproducing book illustrations by woodcuts. It was invented in China in 2500 BC, but is not known to have been used in Europe until the seventeenth century. The block was made of layers of wood sandwiched together, one side of which had a raised printing surface that varied depending on the type of cloth and the pattern to be printed. Three types of block were commonly used to print on cotton cloth: line blocks for printing outlines and small details; blotch blocks with felted surfaces for large areas of colour; and ground blocks, also felted, for small areas of colour. Each colour was applied with a different block, and there could be over a 100 blocks in a set.
- 3.3.3 During the nineteenth century, it became commonplace for a print works to form part of a larger bleaching and dyeing concern, providing a cloth-finishing service to the textile trade. A large print works would employ a few hundred hand-block printers, each man with his own printing table, and many firms even had their own block-making department. A block printer frequently worked with a tierer, usually a child, who pushed a trolley of printing colour along the printing table (Plate 3).
- 3.3.4 There are a few contemporary accounts of children working in print works during the nineteenth century. One such account was provided by Ralph Rooney of Tottington, who was born at Shepherds Cottage in March 1862, and commenced work at the age of seven as a 'half-timer' in Tottington Print Works, assisting the block printers as a tier boy. However, at the age of ten, Rooney sought work in a weaving mill in Tottington, presumably as it offered better wages than the print works (Rooney 1947, 1).



Plate 3: An early nineteenth-century engraving of a block printer and tierer at work

- 3.3.5 The introduction of the machine printing of cloth by roller or cylinder can be traced to 1772, when a patent (no 1007) was granted to Charles Taylor, Thomas Walker, and Joseph Adkin, all of Manchester, for printing by engraved wooden rollers (Turnbull 1951). This was improved upon by engraving the pattern on copper rollers, which was introduced in the 1780s when Thomas Bell of Walton-le-Dale took out a patent in 1783 (no 1378) for a copper-covered roller engraved on its curved surface. This worked in the reverse manner to hand blocks, *ie* the engraved lines were the printing area, and smooth areas were kept clear of colour. Instead of the pattern being on a flat surface, it was engraved around a copper roller. There were many ways of making the pattern on the copper roller: hand engraving; mill engraving where the pattern is pressed into the copper; or etching, where the pattern is cut into the copper surface by acid. There were attempts to mechanise block printing, but they could not compete with the speed of roller printing machines, which gradually superseded hand-block methods during the first half of the nineteenth century (Ashmore 1969). Nevertheless, in his autobiography, Ralph Rooney noted that during the 1860s block printing ‘all over Lancashire was in a flourishing position, and the machine printing was just making a little headway’ (Rooney 1947, 1).
- 3.3.6 On a printing machine, cloth was passed continuously from an overhead roller through the nip between the engraved roller and a plain roller called a pressure bowl (Plate 4). The lower part of the engraved roller dipped into a colour trough, and as it revolved its surface was wiped clean by a doctor knife before the cloth reached it. Colour was thus left only in the engraved lines, which transferred the pattern onto the cloth. At first, only single colours were printed, but soon multi-colour machines were invented with several rollers, each carrying part of the pattern and fitted with its own colour trough and doctor knife. The cloth passed each roller in sequence, building up the final multi-coloured design (Baines 1825).

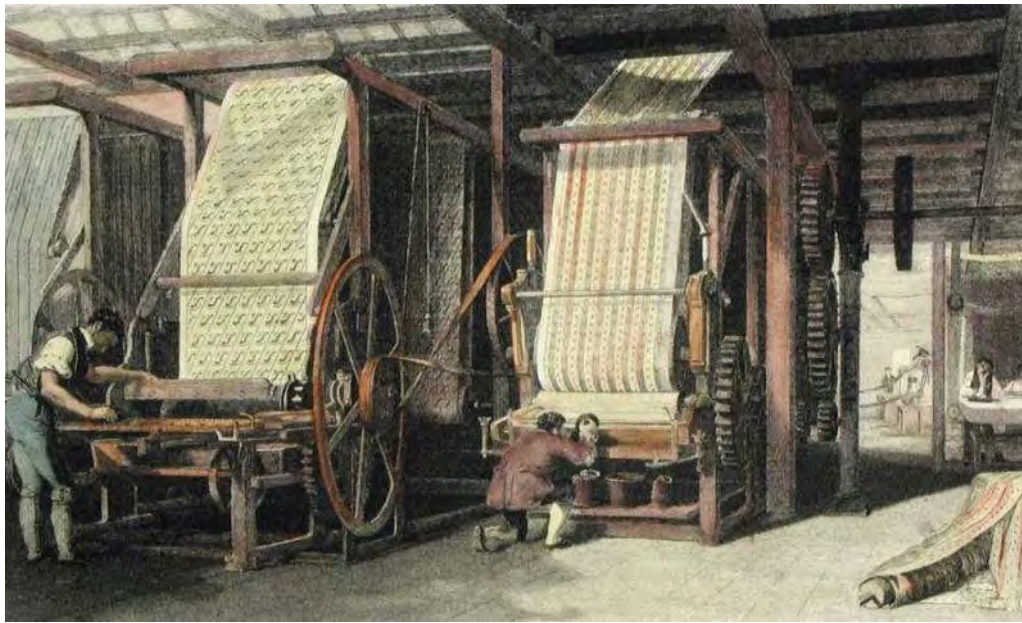


Plate 4: The mechanised calico-printing process in the 1830s, showing on the left a machine with engraved copper rollers transferring the pattern onto the cloth, and on the right is a block printer using a hand-carved wooden block.
(drawn by T Allom and engraved by J Carter)

- 3.3.7 Once printed, the inks had to be fixed to the cloth, and any excess mordant or other chemicals needed to be removed. The first process, known as ageing, aimed to remove the mordants and acetic acid used to fix the dyes to the cloth during the printing process. This process was only really understood after c 1800, when it was realised that moisture was also required during the drying of the cloth in order to ‘age’ (fix) the colour (Turnbull 1951, 62). In the humid atmosphere of England, it had been sufficient for ageing rooms to be placed near rivers or ponds (*ibid*). These rooms were originally heated by flues from fires, and later by steam pipes, but as it became necessary to reduce the ageing time, which had previously been about four days (*ibid*), whilst increasing the quantities of cloth, the amount of steam required in the ageing rooms soon became too great for men to work within (*op cit*, 64).
- 3.3.8 The first enclosed steaming machine was invented by John Thom in 1849, and was further developed by Walter Crum in 1856. Uptake by the major print works ensued, culminating in the highly successful ‘Rapid Ager’, patented by Mather & Platt in 1879, which comprised an enclosed metal steaming chamber with rollers for continuous running. This revolutionised the processing of prints and long outlived the types of colour (mordents and vegetable colourings) for which it was first devised (Mather & Platt 1958).
- 3.3.9 After the cloth had been aged, it still contained several impurities: excess mordant rendered insoluble by steaming; surplus insoluble compound; and thickening matter (gums and starches) used during printing (Turnbull 1951, 66). It was discovered in the mid-eighteenth century that cow dung, mixed with water, was an efficient agent for removing these residues, and its use in the process, which became known as ‘dunging’, continued well into the twentieth century (*ibid*).

- 3.3.10 An account of dunging from 1911 (Murphy 1911, 34) describes a dunging range as having three baths, the first being heated to 75°C, and containing ‘512 gallons (2328 litres) of water, 16lb (7.3kg) of phosphate of soda, 16lb (7.3kg) of ground chalk, and 8lb (3.6kg) of ammonia liquor’. The second bath, for which no temperature was specified, so was presumably cold, was of similar constituents except that the ‘ammonia liquor’ was replaced with ‘100lb (45.4kg) of cow dung’. The final bath, again at 75°C, contained ‘500 gallons (2273litres) of water, 50lb (22.7g) of cow dung and 5lb (2.3kg) of ground chalk’. The cloth was passed on roller through the first two baths over a period of around one minute, but remained in the final bath for approximately half an hour (*ibid*), following which it was washed thoroughly with water.
- 3.3.11 The calico-printing trade remained prosperous until the 1880s, machines increasingly replaced the old block tables and capacity expanded greatly. However, there were 25 failures of firms between 1889 and 1892, largely as a result of inefficiency, bribery, price cutting and long credit (Turnbull 1951, 121). The solution was amalgamation and, between 1897 and 1899, some 90 per cent of the printing trade grouped itself into three associations: F Steiner & Co; the United Turkey Red Co; and (the largest) the Calico Printers’ Association (CPA).
- 3.3.12 The Calico Printers’ Association Ltd was an amalgamation of 46 printing concerns and 13 merchanting concerns, some with weaving and spinning interests, the total number of vendors being 128. The prospectus of the Company stated that ‘the directors believe that amalgamation of interests and definite community of action promise the following advantages: the avoidance of undue or excessive competition and of the selling of goods below cost; large economies to be effected by the centralization of buying and finance and concentration of production; the prevention of overlapping upon the part of firms constituting the Association.’ The Company also believed that it would be possible in the future ‘to carry on work in foreign markets under most favourable conditions as regards designs, engraved rollers etc, and in a way which was not practicable when such action depended solely upon the initiative of individual firms’ (Calico Printers’ Association 1949, 18).
- 3.3.13 **Printing dyes:** the dyes used in all branches of the textile industry until the mid-nineteenth century were natural, and came mainly from animals (*eg* cochineal), plants (*eg* woad, logwood), shell-fish (*eg* murex and purpura, which formed the ‘imperial purple’ of Roman times), and minerals. Indigo and madder were the two most important dyes, both used extensively in Europe in the eighteenth century (O’Neill 1862). Indigo is a plant native to India and other Asian countries and forms a blue dye. Madder is a red dye from the roots of the madder plant, imported mainly from the Middle East. Turkey Red dye, made in that country, could not be copied, and up to the eighteenth century clothes were exported to Turkey for dyeing and re-imported. In 1780, however, Borelles set up the first Turkey Red factory at Blackley near Manchester, after discovering that the secret to the dye was the use of a range of mordants, including oil, oak galls, alum, dung, and ox-blood (Cossons 1975).

- 3.3.14 The simplest way of dyeing was mixing a colouring agent with water in a vat and placing a textile in the dye bath (Plate 5). The fibres would then absorb the colour, although many natural colours do not fix well, or cannot be made into dyes easily; at this time there was no natural green dye, and textiles had to be dyed yellow then blue (Aspin 2000).



Plate 5: A mid-nineteenth-century engraving of the dyeing process (from Barfoot 1840)

- 3.3.15 The first commercially produced synthetic dye was mauve aniline, which was discovered in 1856 by William Henry Perkins, a student of the Royal College of Chemistry. He was trying to make quinine, but discovered that a rich purple dye could be produced by reacting aniline with potassium dichromate and then extracting the dye by adding alcohol. He set up his own company for the dye immediately and, by 1859, this synthetic dye was the height of fashion, with Queen Victoria wearing a mauve dress to the International Exhibition of 1862 (Aspin 2000).
- 3.3.16 The primary raw material required for the production of synthetic dye was coal tar, a high-viscosity brown or black liquid that was a by-product of the coke and gas-producing industries. In order to make it suitable for use by synthetic dye manufacturers, the raw coal tar was subjected to fractional distillation to separate it out into some of its constituent elements. As it was heated, the various component chemical compounds, each with differing boiling points, were collected individually as they evaporated, and then cooled to facilitate condensation. A range of acids, catalysts and oxidising, reducing and nitrosating agents, as well as supplies of fuel and water, was also required to produce synthetic dyes (Murphy 1911).

3.4 BACKGROUND TO THE BLEACHING INDUSTRY

- 3.4.1 In order for cloth to be dyed or printed successfully, it had to be freed from any impurities by bleaching, which was an old-established industry in Lancashire (Ashmore 1969, 60). The traditional method was to boil the cloth in an alkaline ley made from plant ashes and to sour it in buttermilk. The equipment was very simple comprising boiling 'kiers' and troughs or becks of stone or wood, with bleaching being achieved by exposing the cloth to the sun for long periods in bleach crofts (Plate 6). Towards the end of the eighteenth century, however, it was becoming increasingly clear that a more efficient means of bleaching cloth was needed to keep pace with the major improvements in other branches of the textile industry.

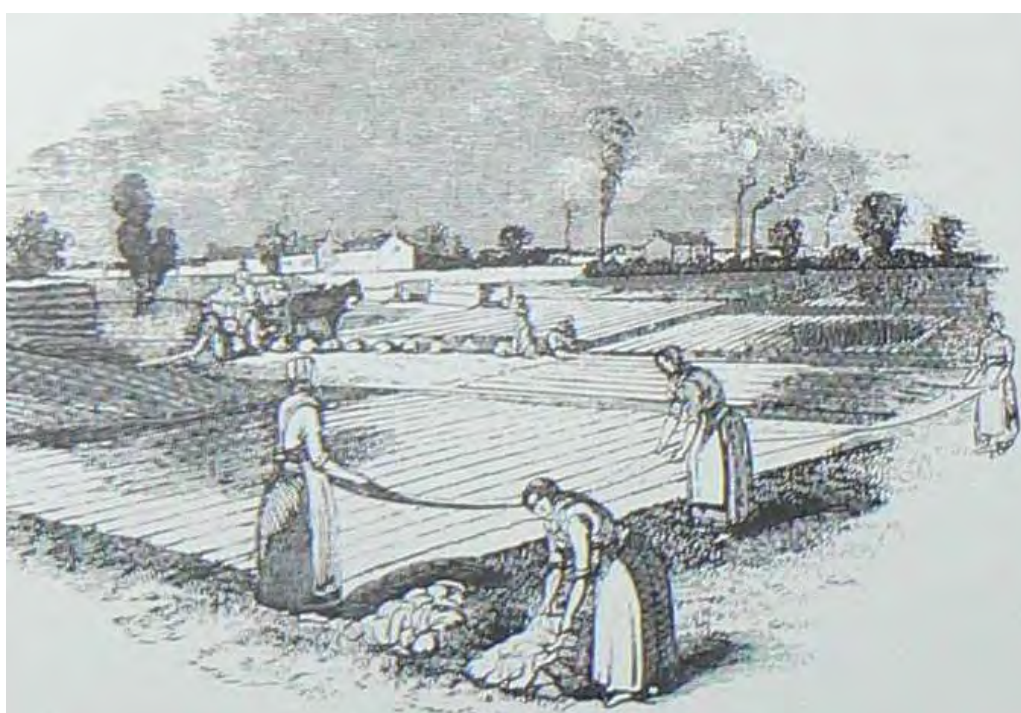


Plate 6: A mid-nineteenth-century engraving of a traditional open-air bleach croft

- 3.4.2 In 1798, Charles Tennant invented a combination of chlorine and lime that met the requirements of the bleaching trade completely. This resulted in the introduction of bleaching powder, patented by Tennant in 1799, which was made by impregnating dry-slaked lime with chlorine gas (Murphy 1911, 133). Another major development in the bleaching industry during the late eighteenth century was the introduction of mechanisation; water and steam power began to be used to drive the machines, including dash wheels, washing machines, squeezers, mangles and calendars (Ashmore 1969, 61). These innovations, together with an exponential growth in the demand for cotton goods, led to the widespread adoption of the factory system with the transferral of the bleaching process indoors, although some traditional bleach crofts did remain in use in rural areas.

- 3.4.3 The adoption of the factory system allowed bleaching to become a continuous process, which was carried out in specialised factories, or dedicated departments within print works. An essential initial stage in the process was to remove any fibre remaining on the surface of the cloth, such as frayed filaments from weaving, in order to obtain a perfectly smooth surface (Ashmore 1969, 61). This was achieved by singeing the cloth over red-hot copper plates in a singe house, which would contain a singeing machine heated by either gas flames or a stove underneath (Plate 7). Once it had passed over the heat source, the cloth was fed immediately through a trough of water to extinguish any sparks. Another prerequisite of the bleaching process was to sew numerous lengths, or pieces, of the cloth together, forming a continuous rope of cloth that could be up to eight miles long (Dodd 1844, 47). The cloth could then be moved between the various bleaching processes by winches, which drew the rope of cloth through overhead porcelain eyes.

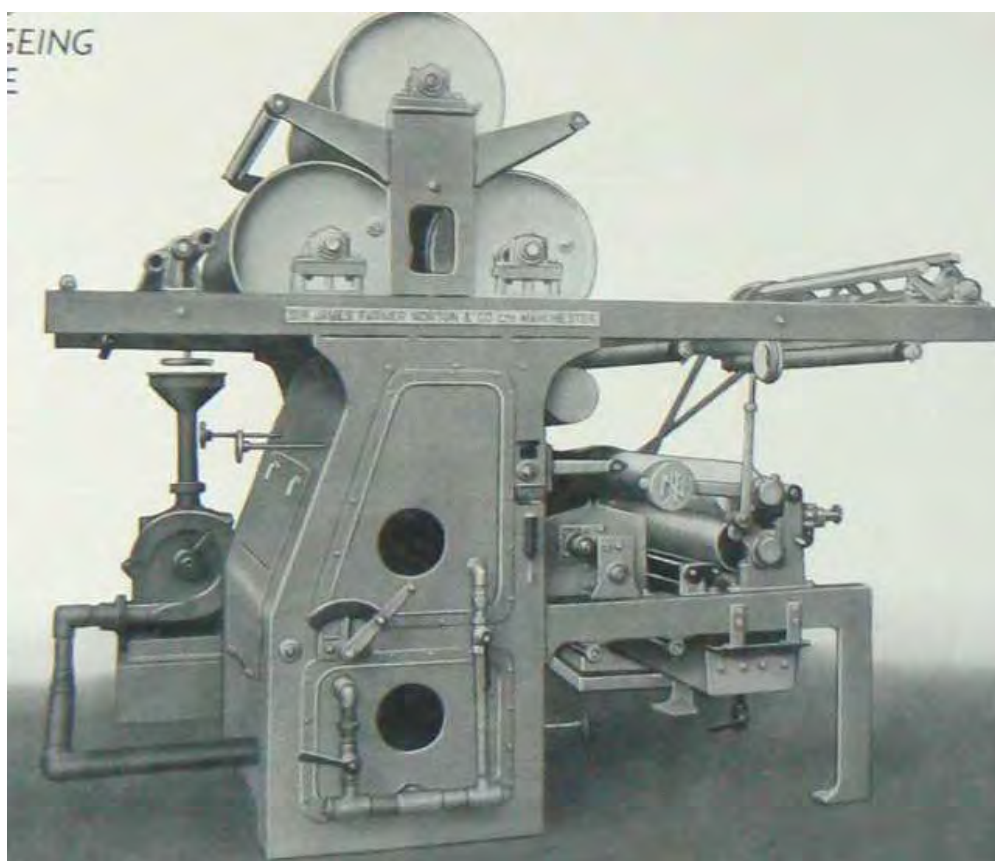


Plate 7: A twentieth-century singeing machine manufactured by James Farmer Norton Ltd

- 3.4.4 The cloth was passed to the bleach croft and subject to the ‘grey wash’ process. The bleach croft was one of the largest areas within the bleach works and contained many items of machinery, including steam engines, washing machines, a liming machines, a high-pressure kiers, and cisterns. Initially, the cloth was alternately impregnated with scouring liquor, washed in a dash wheel, and squeezed dry through rollers (Plate 8). This process removed through chemical action any dirt and size that had been applied during the weaving process. The cloth was then boiled for several hours in a kier, a large iron vessel filled with a solution of caustic soda. Boiling in lime, or ‘bowking’, circulated the solution continuously through the cloth at a high temperature.

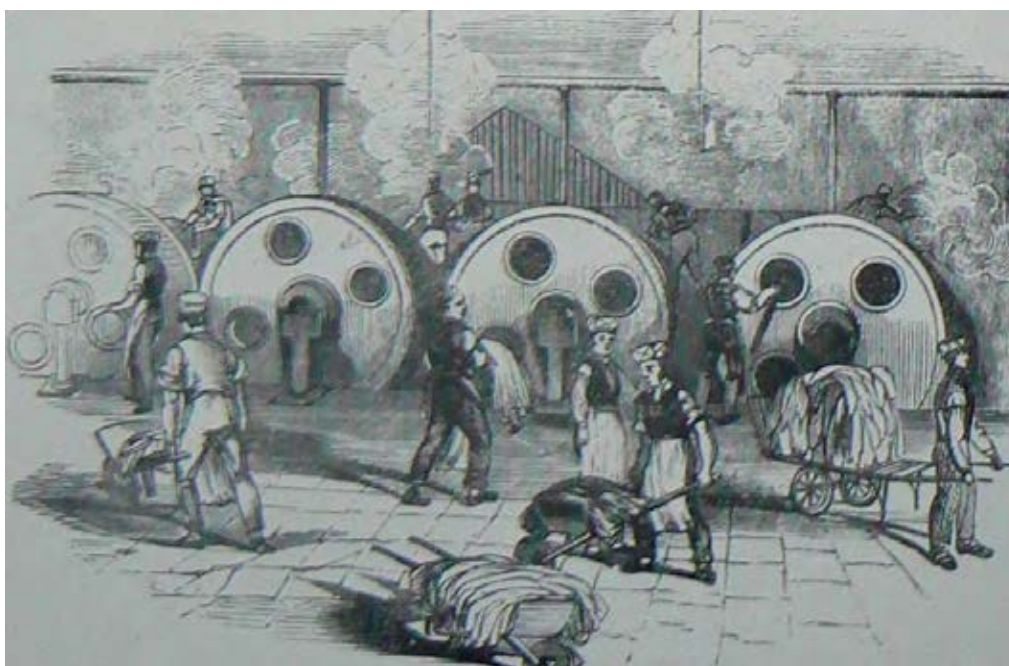


Plate 8: Dash wheels at the Dukinfield bleach works of Thomas Hoyle & Sons in 1843

- 3.4.5 The cloth was then subject to the ‘grey sour’, which involved treating the cloth with a weak solution of hydrochloric acid to dissolve any vestiges of lime, and was then washed thoroughly. Cloth was frequently boiled twice in kiers with soda and washed again. The next process was the bleaching, or chemicing, process that was intended to destroy what remained of the natural colouring matters in the fibre. This was achieved by passing the cloth through a clear solution of chloride of lime, or bleaching powder. It was then allowed to lie for several hours whilst the necessary chemical reactions took place. The cloth was passed through a dilute solution of sulphuric acid, a process known as the ‘white sour’, followed immediately by a final washing in clean water, which rendered the cloth perfectly pure. The cloth was then passed through padded squeezing rollers and drying cylinders. The drying process was completed in the ‘hanging stove’. Stretching machines rectified any shrinking in the cloth. The finishing process also required the cloth to be evenly and finely damped, fulfilled by the damping machine.
- 3.4.6 Bleachers had always established their operations close to plentiful water, but with the introduction of steam power to drive the machines they also required access to coal. By the early nineteenth century, the Bolton area had developed as a major centre for the textile-bleaching trade, with another concentration of works emerging around Stockport, although there were bleach works in most of the East Lancashire parishes (Phillips and Smith 1994, 176).
- 3.4.7 These changes speeded the process and made it possible to work all year round. By 1860 the bleaching trade had virtually completed its transition to an indoor chemical-based operation, the cloth being wound quickly through the crofts by steam power. In tandem with this technical evolution of the bleaching industry was the growth of textile engineering, which had become a recognised branch of the engineering industry by the mid-nineteenth century, resulting in the general improvements of bleaching plant (Sykes 1926, 15).

3.5 BACKGROUND TO TOTTINGTON PRINT WORKS

- 3.5.1 In 1820, Tottington Cotton Mill was purchased by Joshua Knowles, who converted it to calico-printing, beginning a rapid expansion of the site (Graham 1846, 435). Joshua Knowles had commenced his career in the textile industry as an apprentice for the Grant Brothers of Ramsbottom, where he received instruction in the calico-printing business (*The Times*, 21 May 1904). Having established his own business at Tottington Mill, he ‘carried on rather a spirited trade for some years and then he took in a partner George Nelson who is at the Manchester end’ (Graham 1846, 435).
- 3.5.2 There is little documentary evidence for Knowles’ early occupation of the print works, although he is listed as a calico printer in trade directories for 1824 (Pigot and Dean 1824, 338; Baines 1825, 584). Another early reference to the print works occurs in 1833, when a fire broke out at the mill: ‘A great quantity of valuable property was in danger’, although most was saved and the final damage was estimated at £500 - £600 (*Preston Chronicle* 20 July 1833).
- 3.5.3 In 1836, Joshua Knowles’ 15 year-old step brother, Samuel Knowles, commenced an apprenticeship at Tottington Mill. Samuel went through all the different departments of the business, and ‘on the completion of his apprenticeship a great deal of responsibility in connection with the works was placed upon him’ (*The Times* 21 May 1904). Samuel Knowles was accredited with introducing a ground-breaking system of oxidising and precipitating colours by means of chlorate of potash, a development ‘which did much to enhance the reputation of the firm’ (*ibid*).
- 3.5.4 On 9 May 1839, a handbill was issued by the local constabulary offering a £20 reward for information on the theft of six pieces of printed calico that were taken from Joshua Knowles of Tottington Mill. This followed on from the theft of five similar pieces in the previous month (LRO CBWA 1/147). In the days before widespread photography and telegraphy, printed notices were the most effective way of broadcasting descriptions of missing persons, animals or property, and in many instances offered a reward for a successful apprehension or prosecution.
- 3.5.5 A detailed survey of the site is provided by the tithe map of 1842 (LRO DRM 1/98), which shows the works as two blocks of irregular-shaped buildings north of Kirklees Brook, with an arm extending from the western block across the brook (Plate 9). Three reservoirs are shown to the west of the main mill buildings; a large kidney shaped reservoir at the west, and two smaller reservoirs between the larger one and the mill buildings. In between these two smaller lodges are depicted four small blocks of outbuildings.
- 3.5.6 The tithe schedule lists those land holdings that belonged to Samuel Knowles (Table 1). A building range (Plot 741) on the northern bank of Island Lodge is listed in the tithe apportionment as a barn and stable, and a row of five cottages. These are listed under the entry for Tottington Mill, implying that they formed part of the mill complex. Another row of five cottages (Plot 775) is also listed as part of the mill premises. By this date, the mill housed five printing machines, and 95 hand-block printing tables (Ashmore 1982, 143).



Plate 9: Extract from a 'Plan of the Township of Tottington Lower End', 1842

Plot No	Description
731	House, barn, cowhouse, stable, yard and garden
736	Six cottages
737	Print and bleach works, dye houses, engines
737a	Waste
738	Reservoirs
739	Reservoir
739a	Reservoir
740	Reservoir
741	Barn, stable and five cottages

Table 1: Detail of some of Joshua Knowles' plot holdings recorded in the tithe apportionment

3.5.7 It was during this period that Joshua Knowles was joined in partnership with George Nelson, the proprietor of a warehouse on George Street in Manchester, together with E Bond and Samuel Beswick, and the business was carried on thereafter under the name of Messrs Nelson, Knowles & Company. The first reference to this firm in trade directories occurs in 1843 (Pigot and Slater 1843), whilst earlier directories just list Joshua Knowles (*eg* Pigot and Slater 1841, 32).

3.5.8 According to the Second Report of the Commissioners on Trades and Manufacturers on Children's Employment in 1843-5, there were recorded instances in Lancashire in which children began work in the calico-printing industry as young as four or five, with the great majority commencing employment at ages between eight and nine. In the Report of 1843, the firm of Nelson, Knowles & Co is listed as the owners of Tottington Mill, and

accredited with employing 144 adult males, four adult females, 96 boys and ten girls ages 13-18, and 95 boys and 44 girls aged less than 13. During the same year, the original partnership of Messrs Nelson Knowles & Company was dissolved, as E Bond left the firm (*Manchester Times*, 2 December 1843).

- 3.5.9 In 1846, John Graham completed his comprehensive gazetteer of calico print works in the Manchester region. He accredited Tottington Print Works with housing two steam engines, one of 14hp and one of 18hp; water power was not employed. These steam engines powered seven printing machines, two of which, notably, were six-colour printing machines. The works also had 95 printing tables, employed 74 block printers, and was reported to be 'rather busy both with blocks and machines'. It was noted that the works produced some delaines, whilst 'all the block work is rainbows' (Graham 1846, 435). In the same year, Isabella Kenyon, a ten-year old girl, was killed at the print works when her clothing got entangled in the machinery (*Manchester Times*, 4 September 1846). It was also during 1846 that Joshua Knowles was appointed as a Justice of the Peace for the Bury area (*Manchester Times*, 12 June 1846).
- 3.5.10 In August 1848, the partnership of George Nelson, Joshua Knowles and Samuel Beswick was declared bankrupt. The partners were described as 'merchants' (*Manchester Times*, 12 August 1848). However, Nelson and Knowles evidently continued in business at Tottington as calico printers.
- 3.5.11 Census Returns for 1851 record the population of Tottington at 10,691, of which more than half were under 20 years of age. Some three years previously, the Ordnance Survey published their 6": 1 mile map of the area (Plate 10; Fig 2). This shows broadly the same configuration of buildings at the works as depicted on the tithe map of 1842. One notable difference is that Mill House had been extensively remodelled as Tower Terrace.



Plate 10: Extract from the Ordnance Survey first edition 6": 1 mile map, published in 1848

- 3.5.12 Tower Terrace derived its name from the gatehouse tower that Joshua Knowles erected as part of the remodelling. This still bears the date stone '1840 JK', providing a date for the remodelling. Knowles appears to have modelled the new building on Nuttall Hall farm, the residence of his former employers in Ramsbottom, the Grant Brothers (Hartwell 2004, 665).
- 3.5.13 In 1851, Joshua Knowles exhibited examples of his printed cloth at the Great Exhibition at the Crystal Palace in London. It was recorded at the Exhibition that 'the goods exhibited by Messrs Nelson, Knowles & Company as being worthy of notice in the history of the calico printing trade' (*The Times*, 21 May 1904), and ultimately gained them a prize in the printed cottons section (*Daily News*, 27 September 1851). The firm's exhibits also attracted the attention of a reporter with the *Manchester Times*, who commented on 'the wonderful fourteen-coloured furniture, with its broad blotch, in two effects' (*Manchester Times*, 17 May 1851). This credit was probably in no small part due to the firm's foreman engraver, John Ryder, and the foreman machine printer, Robert Howarth, who had introduced a system of engraving 'that gave a great impetus to the trade'. This enabled them to print a 'blotch' colour all over the face of the cloth, whereas it had previously been impossible to print blotch wider than 1" or 1½" (*The Times*, 21 May 1904).
- 3.5.14 Joshua Knowles had three daughters. The eldest, Frances, married William Wood of London in September 1850 (*The Standard*, 23 September 1850). Joshua's second daughter, Alice Eliza, married John Ormerod Openshaw, of the Bury firm of textile manufacturers, in December 1852 (*Manchester Times*, 4 December 1852). The youngest daughter was Charlotte, who married R Johnson, a Manchester-based stationer, in March 1857 (*Blackburn Standard*, 25 March 1857).
- 3.5.15 By 1853, the firm had a showroom and warehouse at 52 Mosley Street in Manchester (Collinson 1853). In April of that year, an incident at the print works was the cause of considerable concern. An alarm of a fire was raised in Bury, and 'a report quickly circulated that the extensive works of My Joshua Knowles, Tottington, were being consumed'. However, the cause of the smoke that had been witnessed was actually a bonfire that had been lit to burn some rubbish at the works (*Manchester Times*, 2 April 1853). A few months after this incident, on 20 September 1853, Joshua Knowles died at his residence in Stormer Hill. He was aged 59 (*Manchester Times*, 21 September 1853).
- 3.5.16 Following the death of Joshua Knowles, the print works was leased by his widow, Sarah Knowles, and William Hardman to Samuel Knowles; George Nelson, Joshua Knowles' former business partner, had retired by that date (*The Times*, 21 May 1904). The original lease, dated 5th March 1855, was for nine years at an annual rent of £1,000 (GMRO M159/2/28). According to the lease, Sarah Knowles undertook to 'expend the sum of £500 in the erection of additional machinery or in the alteration or improvement of the machinery at present' within six months of commencement of the new tenancy. The lease also contained a schedule itemising machinery in the works (Table 2). It is of note that this refers to machinery in the 'bleach works' and also in the 'old bleach works', implying that the works had been subject to at least one phase of expansion.

POWER PLANT Seven steam boilers Two condensing steam engines Shafting	IN THE YARD Large weighing machine
MACHINERY IN THE BLEACH WORKS Four kiers One sour pump One chemic pump One pair of squeezers Two washing machines	MACHINERY IN THE OLD BLEACH WORKS Four wash wheels One pair of squeezers Fifteen stand winches Two hand becks One soaping kier
MACHINERY IN THE PRINTING ROOMS One 12 colour printing machine with small high pressure steam engine One 8 colour printing machine with small high pressure steam engine Two 6 colour printing machine with small high pressure steam engine Three 4 colour printing machine with small high pressure steam engine One 1 colour printing machine with small high pressure steam engine Two steaming boxes Two fly-dung becks Nineteen dye becks One washing machine with small high pressure steam engine One washing machine Five wash wheels	
MACHINERY IN THE FANCY DYE HOUSE Two preparing machines Six hand winches Two wash wheels One hydro-extractor One iron cistern	MACHINERY IN THE GARANCINE HOUSE One lead boiler Four filters One hydraulic press One lead cistern
MACHINERY IN THE CALENDER HOUSE Two calenders One weighing machine	MACHINERY IN THE COLOUR SHOP One weighing machine
MACHINERY IN THE TIN DRYING ROOM Three drying machines Two iron mangles for finishing	MACHINERY IN THE MECHANICS SHOP Lathes Planing machines

Table 2: Schedule of machinery at the works specified in a lease of 1855 (GMRO M159/2/28)

3.5.17 There are two Valuation Lists for Tottington Lower End that were compiled in 1864. The first of these lists Sarah Knowles as the owner of Tottington Mill, with Samuel Knowles & Co as the occupier (BA PUB/8/21). The mill is given a rateable value of £486 16s, although a detailed inventory of the premises is not provided making it difficult to assess the full extent of the building that were evaluated. Sarah Knowles is also accredited with owning the coach house at Tottington Mill, rated at £3 7s, which was occupied by Samuel Knowles & Co. Mill House Row owned by Sarah Knowles, and occupied by Robert Hadfield, William Chadwick, Joseph Wardle, Christopher Rooney, Thomas Barow, and John Grimshaw.

3.5.18 A second Valuation List for 1864 gives Samuel Knowles & Co as both the owner and occupant of Tottington Mill, suggesting that the firm purchased the premises from Sarah Knowles when the nine-year lease of 1854 expired. The firm is also given as the owner and occupier of the Tower at Tottington Mill, together with a slaughter house, stables and loft, and implement place. This Valuation List names all the component buildings at the print works (Table 3), and gives a total rateable value of £882 14s 6d, representing a considerable increase from the earlier valuation (BA PUB 8/21).

Offices	Three-storey school and pattern room	
Store and lumber room	Three-storey hanging room and old roller room	
Addition to printing shop	Small boiler house and drying rooms	
White room	Three-storey boiler house, engine house and rooms over	
Laboratory	Three-storey boiler house and steaming place	
New finishing room	Boiler house and dry room over	
Etching place	Old boiler house and steaming place	
Three-storey engraving shop	Three-storey grinding place, engine house and rooms over	
Wash house	Three-storey machine and drying rooms	
Madder and block rooms	Three-storey machine and stitching rooms	
Dye house	Blue dye house and printing shop	
Drying shed	Blue dye house and drying stove	
Wash house and white room	Four-storey storeroom and block-printing shop	
Drug room	Three-storey store room and drying place	
Colour shop	Three-storey dyehouse and machine room	
Washing-up place	Three-storey calender rooms	
Stable	Coach house and loft	Retort house
Purifying house	Gas works	Gas chimney
Gasometer	Blacksmiths shop	Mechanics shop
Shed in yard	Loading place	Copper roller room

Table 3: Buildings listed at Tottington Print Works in the 1864 Valuation List (BA PUB 8/21)

3.5.19 The next available Valuation List for the print works is for the year 1876. This list itemises four boiler houses (one for the steaming place, and one for the grey room), three engines (including one described as ‘Passage Engine House’), a 60 yard chimney, 40 yard chimney, and an economiser house (PUB/8/44).

3.5.20 In 1876, Samuel Knowles was instrumental in promoting the Bury and Tottington District Railway Company, together with other local manufacturers that included Edward Mucklow of Elton Fold, Richard Olive of Woolfold and Hugh Roberts of Stormer Hill. The construction of a railway line between Tottington and a junction with the Lancashire & Yorkshire Railway’s main line a short distance to the north of Bolton Street station in Bury was authorised by an Act of Parliament of 2 August 1877. However, the line did not terminate at Tottington, but was authorised to continue to Holcombe Brook, creating a route that was three and a half miles long (Wells 2006, 78).

As reported in a local newspaper, it was intended that the line 'would be managed as an independent company, chiefly if not solely, composed of residents in the district, and who, it was expected, would be able to find traffic sufficient to support it' (*Manchester Guardian*, 31 May 1877).

- 3.5.21 Construction of the line from Bury to Holcombe Brook commenced in June 1878, and the route opened for passenger and freight traffic in November 1882. The line was connected by two private sidings: one that served the Stormer Hill Bleach Works; and a second, known as Knowles Siding that accessed Tottington Mill. This consisted of two short, dead-end tracks and a long curving set of tracks that led directly to the mill's boiler house, and subsequently the gas plant, to facilitate the delivery of coal (Wells 2006, 82).
- 3.5.22 The line proved to be immediately profitable, with freight traffic receipts greatly exceeded those of passengers. In July 1888, the Lancashire & Yorkshire Railway took control of the line by an Act of Parliament (Wells 2006, 78-9). In July 1913, this line became the first in the world to be converted from steam to electricity (Plate 11).



Plate 11: Electric motor car on Tottington Viaduct. The mill chimney is visible to the rear

- 3.5.23 By the time of the 1882 Valuation List, a further three engines had been added (one to the grey room and one to the calender room), together with two machine houses, a kier room, and a 508 yard tramway from the branch line to the print works, noted in 1883 as running steam trams (PUB/8/66).
- 3.5.24 In 1883, Samuel Knowles took his eldest son, Joshua, into partnership (*The Times*, 21 May 1904). Four years later, in 1887, Messrs Knowles hosted a visit to their Tottington Print Works from members of the Society of the Chemical Industry, an account of which was printed in the local newspaper (*Bury Times*, 16 July 1887). Having met the visitors at Tottington railway station, Samuel Knowles led the party to the print works, pausing *en route* to view 'the flying railway connecting the Tottington Mill with Kirklees'. This was described to comprise 'an endless steel rope elevated on posts, the rope passing over grooved wheels at the top. To this rope by means of grooved wheels boxes are attached and by a double line are sent to and from the mills' (*ibid*).

- 3.5.25 Once the visitors arrived at ‘the immense works’, they were escorted around all the various departments. ‘The numerous processes required to render the cloth perfectly white from the time it is placed in the lime kiers where it is boiled with a pressure of 40lbs to the square inch, its treatment with hydrochloric acid and so on until it is fit for the market were explained...’ (*ibid*). Whilst walking around the bleach croft, some of the visitors ‘exhibited their agility in selecting dry spots on which to walk and dodging the streams of water that fell from the wooden channels supplying a number of troughs...’ (*ibid*). In the printing department, Knowles explained that some of the machines were capable of printing 12 different colours simultaneously. One of the machines, which had most recently been installed, was reported to be ‘one of the largest (printing) machines yet made’ (*ibid*). It was also during this period that Samuel Knowles & Company took over the Kirklees Mill further down the valley.
- 3.5.26 The expansion of the print works during the second half of the nineteenth century is captured by the detail shown on the Ordnance Survey first edition 25”: 1 mile map of 1893 (Plate 12; Fig 3). This shows both of the main mill blocks now extending over the brook and partially joined together over mill lane with a short covered passageway. The small outbuildings visible around the original reservoirs on the tithe map of 1842 are shown in much more detail with an irregular block at the north-east, a small ‘L’-shaped block to its south-west, and a small rectangular block to the west. A fourth block to the south comprises a rectangular block with what appears to be a circular chimney in its centre. A narrow structure at the south-west end of this building may be an engine house.

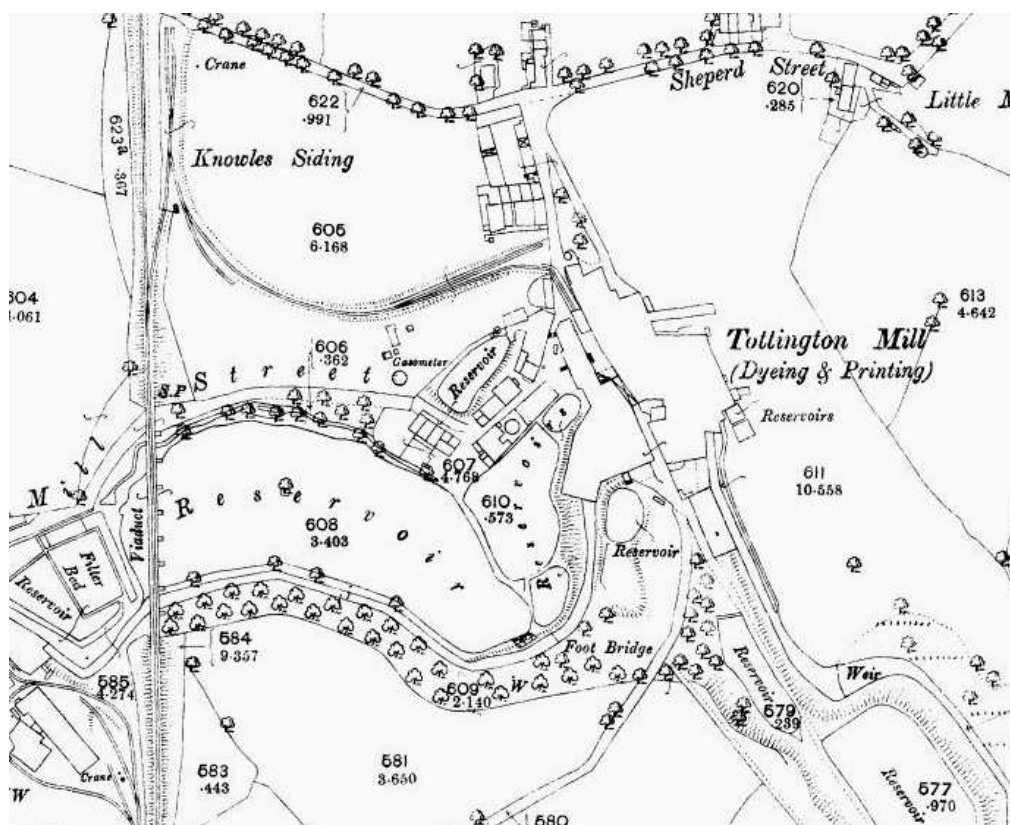


Plate 12: Extract from the Ordnance Survey first edition 25”: 1 mile map, published in 1893

- 3.5.27 In 1892, Samuel Knowles & Company became a private limited liability company. Samuel Knowles retained his position as chairman, with Joshua Knowles and WS Forbes as managing directors (*The Times*, 21 May 1904).
- 3.5.28 The next available Valuation List is for the year 1895 (PUB/8/114). The detail provided in this document indicates that two more boilers (total of five) had been added to the print works, but four engines (one for a grinding place) are listed. The works also has the addition of a cochineal room.
- 3.5.29 In 1899, the firm transferred to the Calico Printers' Association Ltd, which was formed in that year (Craig 1989, 38). The transfer coincided with Samuel Knowles' retirement from the business, leaving Joshua Knowles and WS Forbes as the branch managers, and Robert D Knowles (Samuel's youngest son) as the inside manager of the works (*The Times*, 21 May 1904). At this time, the works housed 19 printing machines and provided employment for 450 workers (Taylor nd, 15). In order to establish the extent of their holdings, the Calico Printers' Association compiled detailed inventories for each of their works. Those for Tottington Print Works were compiled in 1904 (*Appendix 2*), 1909 and 1914, providing a valuable body of documentary evidence. The print works was subject to considerable investment during this period, and the site was expanded, as can be seen on the Ordnance Survey map of 1907 (Fig 4).
- 3.5.30 A useful source of information is an illustration of the print works dating to c 1912 (Plate 13). Presenting the aspect looking north across Lodge 3, the illustration depicts a series of buildings in the north-western part of the site, including the printing and engraving rooms together with part of the engine and boiler houses and their associated chimneys. Another illustration of the print works is a line drawing that is attributed to LS Lowry, and thought to have been produced in 1921. Called 'The Mill Yard', the illustration captures the view looking north through the covered entrance to the print works.

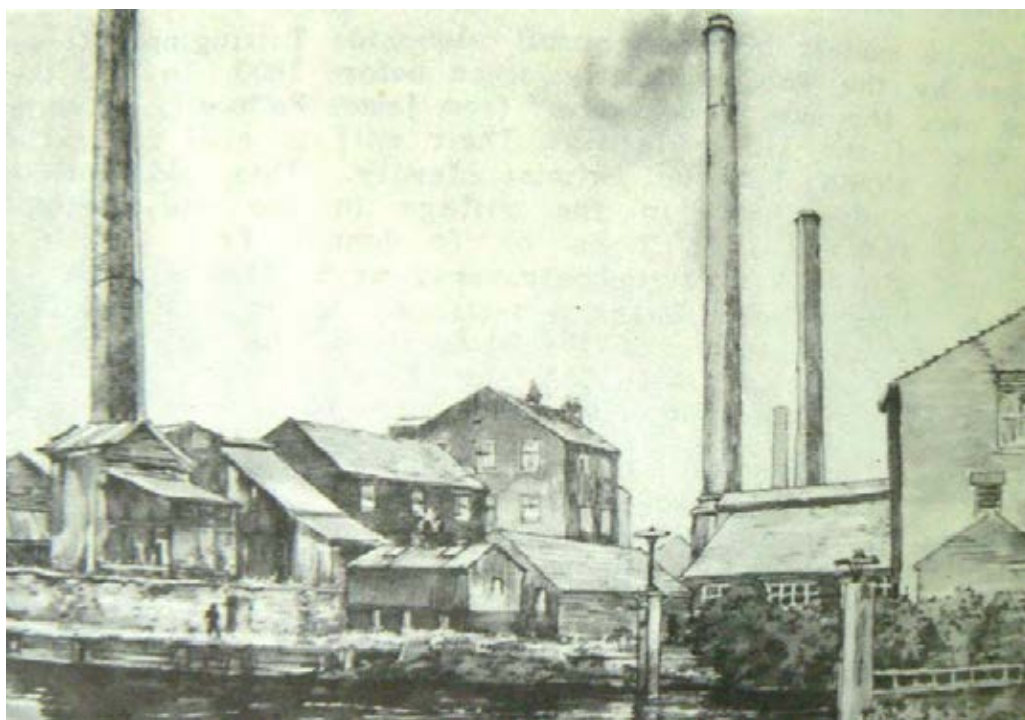


Plate 13: Illustration of Tottington Print Works in c 1912

- 3.5.31 By 1913, there was a total of 80 print works operating in Lancashire. Of this total, only 16 had been established prior to 1846 (Wallwork 1968, 149). One of these was Tottington Print Works, thus representing one of the oldest works in the county.
- 3.5.32 The inter-war years between 1918 and 1939 was a challenging period for the textile-printing industry, characterised by ‘great obstacles that had to be faced in a veritable battle for survival’ (Calico Printers’ Association 1949, 30). Immediately after the First World War, the Association had a total of 29 print works in operation, although trade was reported to be virtually static. There was also an acute shortage of printing colours, and the supply of coal for the steam-power and gas plants was both poor and costly. In addition, foreign competition, particularly from the United States, Brazil and Japan, was aggressively capturing the overseas markets that had previously been crucial to the economic viability of the English industry. In deed, in his address to the general meeting in 1919, the chairman of the Calico Printers’ Association, Lennox Lee, warned that ‘new methods must be devised to meet formidable competitors who are in a more powerful position than ever as compared with other nations suffering from the aftermath of the war’ (*op cit*, 31). Nevertheless, it was widely considered that the long-term prospects were likely to be favourable once difficulties such as exchange control, financial stringency and uncertainty over the general post-war level of prices had been cleared away, enabling the demand that existed in nearly all the markets to be furnished (*ibid*). Nevertheless, the interwar years saw a reduction in the number of print works operated by the Association from 29 in 1918, to just 11 by 1939. This reflected the catastrophic decline in the textile trade; in 1913, the total exports of bleached, dyed and printed goods were 7,080 million yards valued at £98 million, whilst the corresponding figures for the year ending June 1931 were 1,860 yards valued at £43 million. Similarly, in 1923, the annual print exports were valued at £24 million, falling to £18 million in 1928, and plummeting to £8 million by 1939 (*ibid*). An inevitable consequence of this decline in the industry was the closure of a proportion of the Associations’ works to enable the reduced production to be concentrated at a few sites. Tottington Print Works was one of those selected for closure during this period, and whilst the Association’s reasons for its selection have not come to light during the documentary research, it is likely that the comparatively remote location and the resultant high costs of transporting goods and materials are likely to have been important factors.
- 3.5.33 The detail shown on the Ordnance Survey mapping of 1923 and 1930 (Fig 5) suggests that the gasometers and associated buildings had been demolished, although a small circular structure labelled on the map as a tank may be the base of the original gasometer. The southern block of small outbuildings is shown as joined to the western main block.
- 3.5.34 The print works was closed in 1927, and most of the principal buildings were demolished in 1930 (Plate 14). However, the site was purchased by Tootals, who continued to run the engraving shop until the 1940s. The remainder of the mill was demolished shortly after the closure of the engraving shop (Craig 1989, 38-9).

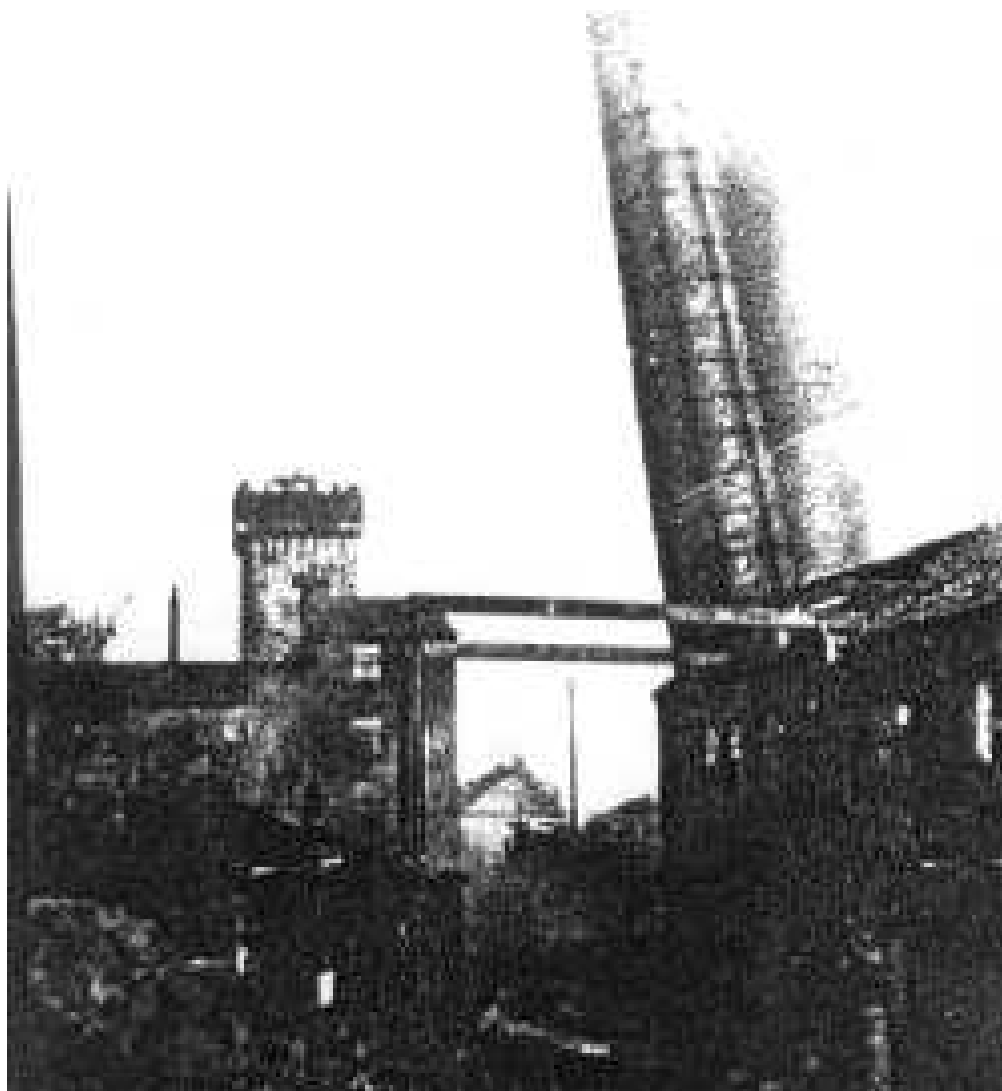


Plate 14: The demolition of the print works in November 1930

- 3.5.35 The Ordnance Survey map of 1960 shows all of the buildings to have been demolished, and the tramway surviving only as an embankment. The reservoirs remain, as does the irregular north-eastern outbuilding that had been present on all mapping from the tithe of 1842. The possible gasometer base, annotated as a 'tank', is also shown on the 1960 map (Fig 6).
- 3.5.36 Since demolition, the vestiges of the buildings have been left to decay naturally, and become colonised by vegetation. The disposition of the site, characterised by the numerous lodges and stone walls, has encouraged a diverse range of habitats to develop, which is reflected in the designation in October 2010 of much of the Kirklees Valley as a Site of Biological Importance. In the same year, the valley became the fifth Local Nature Reserve to be declared in Bury. As such, the site of Tottington Print Works has not been subject to redevelopment, as has been the case for other former industrial sites in the valley such as the Kirklees Bleach Works.

3.6 A TOUR THROUGH TOTTINGTON PRINT WORKS IN THE EDWARDIAN PERIOD

- 3.6.1 Calico printing became a continuous process carried out in specialised factories during the nineteenth century (*Section 3.2 above*). This led to a growth of the engineering and textile machinery industries, which produced an increasing range of new machines during the second half of the nineteenth and early twentieth centuries. Whilst there was considerable variation in the layout of various works, the processes carried out were broadly the same. These processes can be demonstrated by reference to Tottington Print Works, and the details provided by the Calico Printers' Association Ltd Inventory and Valuation of 1909 (M75/4/1/6) and the accompanying plan (Plate 15).

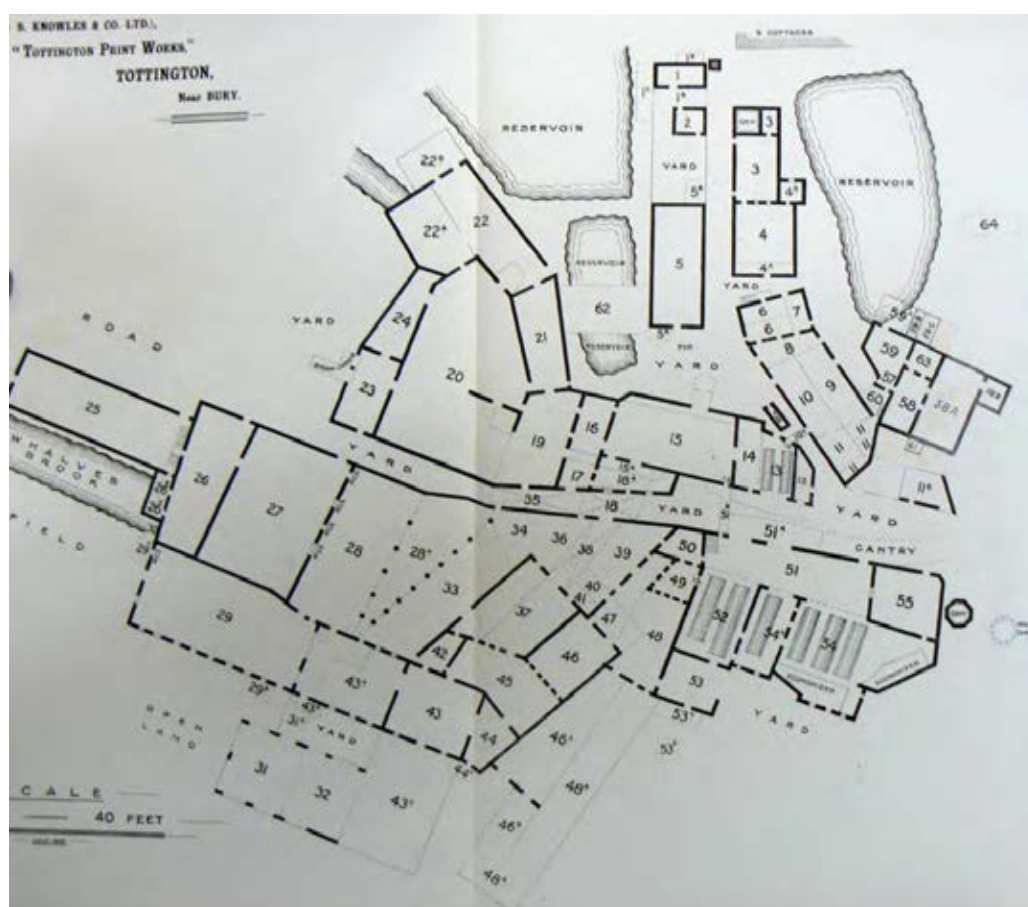


Plate 15: Calico Printers' Association Plan of Tottington Print Works, 1909 (M75/4/1/6)

- 3.6.2 Once delivered to the works, the grey cloth was unloaded via a gantry to the Grey Rooms, which occupied the first and second floors of Room **51** and **52**, over the Boiler House. By 1909, the ground floor of the Boiler House (Rooms **51**, **52** and **54A**) contained a total of six steel Lancashire boilers, each measuring 30ft long and 8ft 6in diameter. The oldest of these had been supplied by JK & R Lord of Bury 1892. Lords supplied a second boiler in 1896, a third in 1898, and a fourth in 1901. The last two boilers were supplied by Yates & Thom of Blackburn in 1904. The Boiler House also contained two fuel economisers, both supplied by E Green & Son of Wakefield, and each containing 288 pipes. The scrapers on one of the economisers were powered by an angular steam engine, whilst the scrapers on the second economiser, which was fitted in 1901, were powered by a vertical steam engine.

- 3.6.3 As an initial stage in the manufacturing process, all the cloth pieces were sewn together, end to end, forming a continuous rope of cloth that could be several miles long (Ashmore 1969, 61). This was carried out in the Grey Rooms, which by 1909 contained three Birch's rotary sewing machines, and a Rayer & Lincoln rotary sewing machine. The machinery was powered by a vertical steam engine supplied by James Mitchell of Bolton. When sewn together, the cloth could then be moved between the various processing rooms by winches, which drew the rope of cloth through overhead porcelain eyes.
- 3.6.4 Once sewn together, any fine fibre remaining on the surface of the cloth and frayed filaments from weaving, were removed to obtain a perfectly smooth surface; failure to remove this material would make the cloth appear cloudy. This was achieved by singeing the cloth over red-hot plates in the Singe House. The Gas Singeing Room (second floor of Room **49**) contained a donkey stitchee powered by a vertical steam engine. The larger Singe House (first floor of Room **55**, over the pipe-fitters shop) contained a double singeing machine with two copper plates and brick-built furnaces, three copper drying cylinders, a wetting-out mangle, and a double diagonal steam engine.
- 3.6.5 The cloth was winched in the form of a twisted rope from the Singe House to the ground floor of Rooms **33** and **34**, where it was subject to the 'grey wash' process. These rooms housed a blanket washing machine, a four-hole dash wheel that was 6ft diameter and 3ft wide, and a flat washing machine (Plate 16), powered by a vertical steam engine. During this process, the cloth was alternately impregnated with scoring liquor and squeezed dry through rollers. The scouring action of the washing machine removed some of the impurities from the cloth, although would not wholly destroy the fine waxy coating on the fibres, and achieved little or nothing towards actual bleaching.

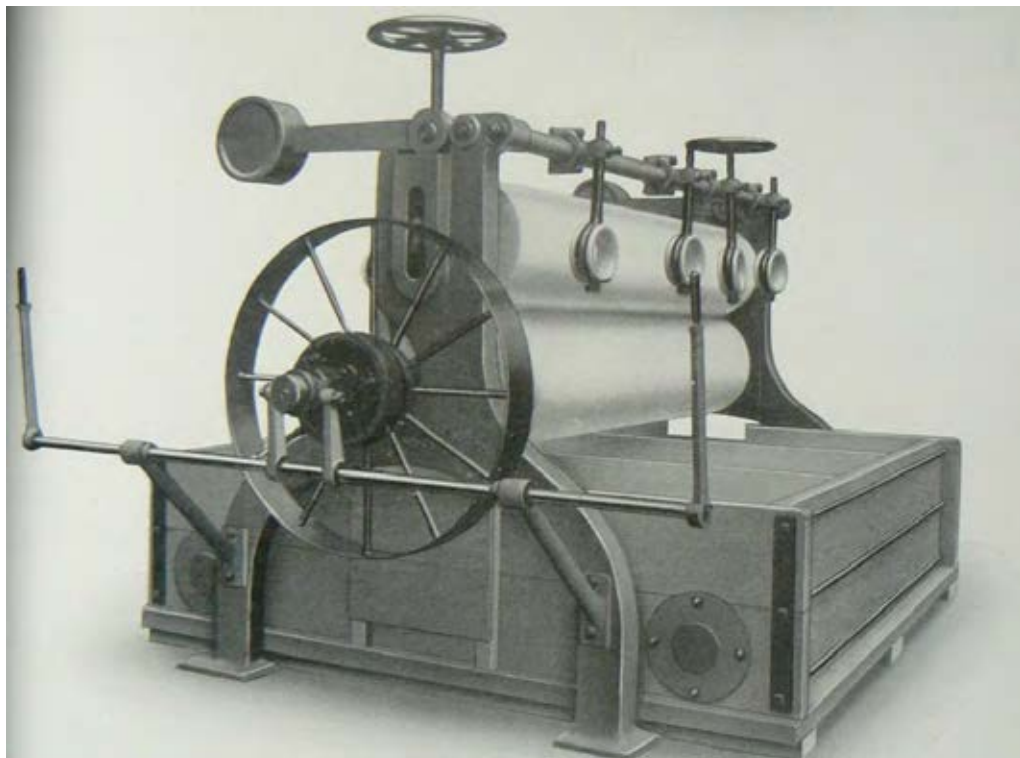


Plate 16: A tight strand washing machine, manufactured by James Farmer Norton & Co Ltd

- 3.6.6 Emerging from the grey wash, the cloth was passed to the Bleach Croft (Rooms 37 and 45), where the principal bleaching processes were carried out. The equipment in the Bleach Croft included a stone chemic cistern measuring 5 x 4 x 4ft (1.52 x 1.22 x 1.22m), four stone steeping cisterns set in the floor, each measuring 8 x 7 x 5ft (2.44 x 2.13 x 2.13m), a horizontal steam engine with a 6in cylinder, a cast-iron cistern, a chemicing machine, a washing machine, an 8ft wide souring machine with a stone cistern, a liming machine, a stone lime cistern in two compartments, two wrought-iron high-pressure liming kiers (Plate 17), each 8ft diameter and 8ft deep (2.44m), and two circular wrought-iron cloth bines, each 7ft 10in diameter (2.39m) and 6ft 6in deep (1.98m) with wooden linings.
- 3.6.7 The cloth was fed initially into the liming and washing machine, where it was alternately soaked with scouring liquor and squeezed dry through rollers, which broke down the impurities by chemical action. The cloth was then boiled in a kier, which involved circulated the lime solution continuously through the cloth at a temperature of at least 100°C.

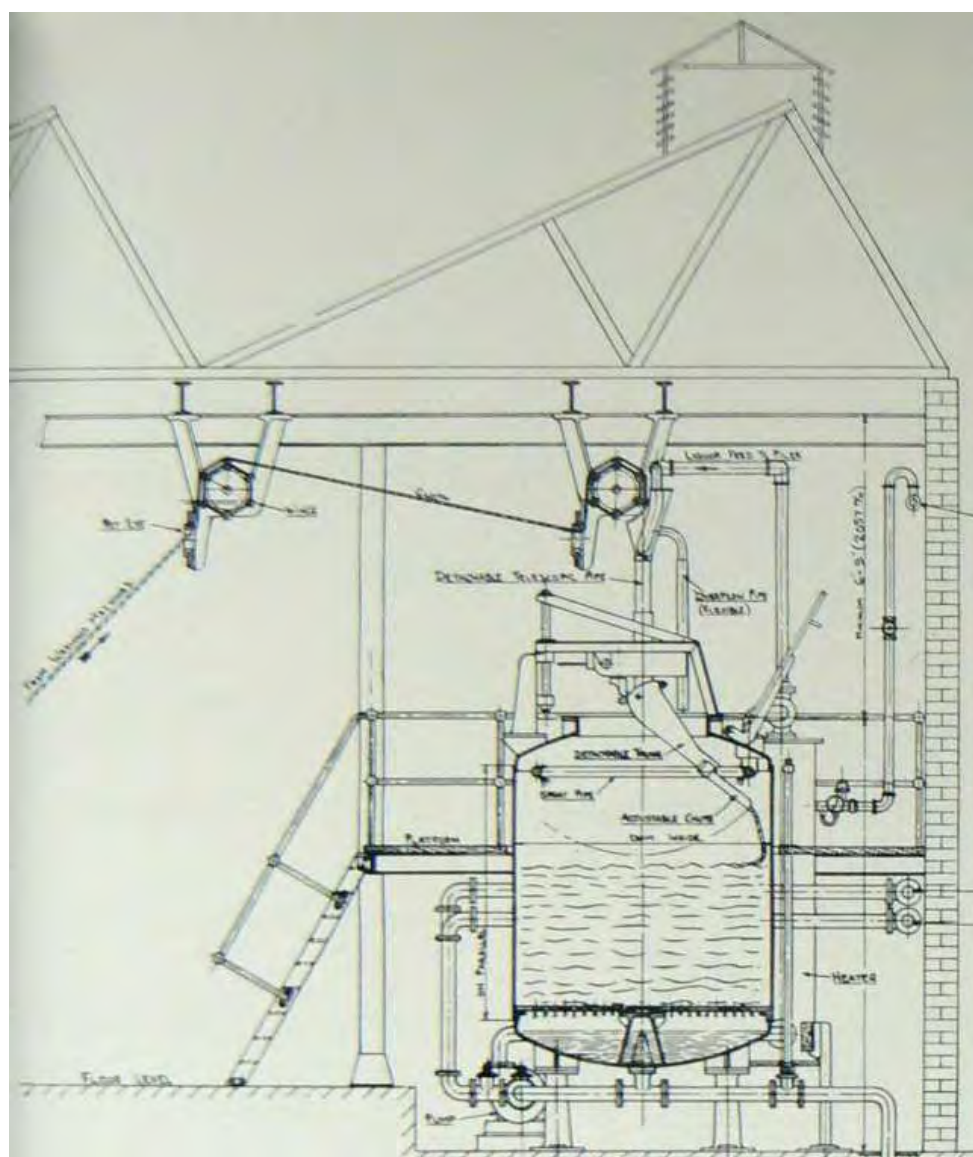


Plate 17: Section through a high-pressure kier installed in a bleach croft

- 3.6.8 The next process was the ‘grey sour’, which involved treating the cloth with a weak solution of hydrochloric acid to dissolve any vestiges of lime and other insoluble soaps, and to remove metallic oxides. This was carried out in a machine similar in construction to the washing machine. Once completed, the cloth was washed thoroughly to discharge all the dissolved matter.
- 3.6.9 The cloth may then have been winched to the High-Pressure Kier House (Rooms **44** and **44A**), which contained five wrought-iron boiling kiers, each of 8ft diameter, and varying from 8ft to 10ft in depth. The cloth will then have been coiled into the kiers, which would have been filled with soda, and boiled to remove all traces of fatty acids. Cloth was frequently boiled twice with soda in the kiers. In the first boil, the cloth may have been treated with soda ash and resin paste previously dissolved by prolonged boiling in caustic soda, but soda ash alone was normally used in the second boil (Murphy 1911, 146).
- 3.6.10 Once the soda ash boil had finished, the cloth was again washed thoroughly. The next stage was the bleaching, or chemicing, process. The chemicing process was intended to destroy what remained of the natural colouring matters in the fibre, and was achieved by passing the cloth through a clear solution of chloride of lime, or bleaching powder. Once the cloth had been washed in the chemic solution, it was allowed to lie for several hours whilst the chemical reactions took place.
- 3.6.11 In order to complete the decomposition of the natural colouring matters and remove the liberated hypochlorous acid, the cloth was passed through a dilute solution of sulphuric acid, a process known as the ‘white sour’. This was followed immediately by a final washing in clean water, which rendered the cloth perfectly pure. The cloth was then passed through a pair of specially padded squeezing rollers, and thence into either centrifugal driers or a range of drying cylinders. In essence, a drying machine comprised a series of steam-heated copper cylinders.
- 3.6.12 The adjacent rooms (Rooms **43-43D**) formed the Cylinder Drying Rooms, the Fancy Dye House, Print Room and Chemic Shed. These rooms contained two chroming, developing and drying ranges with numerous cast-iron cisterns of varying dimensions, a two-bowl ‘blueing’ mangle, and a horizontal drying machine. The chroming process was only applied to a few styles, included aniline black, catechu brown, and colours containing salts of lead that had to be converted into chrome yellow, and was achieved by running the cloth through a vat containing a solution of bi-chromate of potash.
- 3.6.13 The New Fancy Dye House (Room **29**) housed a horizontal steam engine and a clearing and drying range. This comprised a two-bowl chemic mangle and a horizontal drying machine. The room also contained an indigo dyeing range with four cast-iron cisterns, a chemicing and drying range with a two bowl mangle and horizontal drying machine, and a ruby dyeing machine. A weak solution of chemic, or bleaching powder, was applied if any traces of colour remained on the white parts on the printed cloth. The chemic was mixed in a separate shed (Room **43B**), which housed a stone mixing cistern that measured 14ft x 3ft 10in x 5ft 6in, a smaller stone cistern (4 x 4 x 3ft), and a circular cast-iron cistern (2 x 4ft).

- 3.6.14 Room **27** was the Colour Shop, containing a vertical steam engine with a 4ft diameter flywheel and wrought iron shaft for a range of eight copper-cased colour mixing pans, and a range of six copper cavity colour pans. The room also contained two stone washing cisterns and several cast-iron cisterns. The adjacent building (Rooms **28**, **28A** and **33**) housed the machine-printing rooms, which contained two four-colour garment-printing machines, an eight-colour garment-printing machine, a six-colour intermittent garment-printing machine, a twelve-colour handkerchief-printing machine, a twelve-colour intermittent handkerchief-printing machine, an eight-colour handkerchief-printing machine, a six-colour handkerchief-printing machine, a five-colour handkerchief-printing machine, and a vertical drying machine, stentering machinery and 11 steam engines. These were in addition to the printing machines installed on the ground floor of Room **15**, which housed two twelve-colour garment-printing machines, a five-colour garment-printing machine, two four-colour garment-printing machines, a single-colour garment-printing machine, and two eight-colour garment-printing machines. The first and second floors of Rooms **28**, **28A** and **33** were used as drying rooms, containing numerous drying cylinders. Passing up to the first floor of Rooms **28**, **33**, **34** and **42**, the cloth entered the Machine Drying Room, which housed numerous copper and tin cylinders.
- 3.6.15 Room **43** was the Plaiting Down and Piece Room, which housed two sets of plaiting-down apparatus. The second floor of the adjacent rooms (Rooms **43A** and **43B**) was the Print Room.
- 3.6.16 The Finishing Room in this part of the works complex was housed on the first floor of Rooms **34**, **35**, **36**, **38**, **39**, **47** and **48**. Amongst the machinery housed in these rooms were belt stretching machines, a seven-bowl friction calender, a wrought iron starch mixing and boiling pan, a back starch and drying range.
- 3.6.17 Rooms **48A** and **46B** were the Stentering Rooms, where the wrinkles and creases in the cloth derived from the wet processing were smoothed out. These rooms housed a two-bowl mangle, a horizontal steam engine, a set of four copper drying cylinders, and a Mather & Platt Patent Self Clip Hot Air Jigging Stentering machine.
- 3.6.18 The buildings forming the western part of the print works were dominated by the Dye House (Room **20**). This housed numerous machinery, including an open dunging range that comprised five cast-iron cisterns fitted with 32 copper rollers and ten copper shell carrying bowls, two second dunging machines, two wince dyeing machines, a range of four wince dye becks, each measuring 12ft (3.66m) wide, and another range of four wince dye becks, each measuring 9ft (2.74m) wide. Other machinery included a washing-off machine, two 10ft flat washing machines, two 9ft 6in flat washing machines, an 8ft flat washing machine, a range of five soaping machines and two larger soaping machines. Soaping was important to obtain the best results from the printing process. Aniline black and alizarine dyed colours, for instance, were brightened and enhanced by a long, hot and strong soaping, whilst direct dyeing colours and basic colours required only a moderate soaping.

- 3.6.19 Power to the machinery in the Dye House was provided by two horizontal steam engines, each with a 6in cylinder and 12in stroke and fly and nut driving wheels. The power was transmitted via a 72ft (21.94m) long wrought-iron main shaft routed beneath the floor, which connected with wrought-iron upright shafts and wrought-iron line shafts.
- 3.6.20 Situated to the north of the Dye House was the Machine Printing Room and Drying Room (Room **15**), which housed three horizontal steam engines in the basement, together with two lead-lined stone steeping cisterns (each measuring 6 x 3 x 3ft) on stone-built supports, a high-pressure horizontal steam engine with a 10in cylinder, and double ram single-acting Cameron steam pump, and a double-ram vertical steam pump. The ground floor was used as a machine-printing room and housed eight garment-printing machines, whilst the first and second floors were used as drying rooms, containing numerous drying cylinders.
- 3.6.21 The building immediately to the west of the Dye House comprised the Dynamo House, Stentering Room, Winding-on and Marking Rooms (**21**). By 1909, the Dynamo House on the ground floor a horizontal steam engine with a 9" cylinder, and a compound wound electric dynamo manufactured by Thomas Parker Ltd. The first floor was used for stentering, and housed two self-clip stentering machines supplied by Mather & Platt, and a high pressure horizontal steam engine. The second floor was used as winding-on and marking rooms, containing sewing machines, winding-on and brushing machines, and a double cylinder shearing machine.
- 3.6.22 The print works required a constant and regular supply of water; a sample of large print works studied in the 1860s as part of a Parliamentary Commission on river pollution showed that each works consumed 400,000,000 gallons of water annually (Wallwork 1968, 147). The principal source of water for Tottington Print Works was the Kirklees Brook, which was also exploited by several other works along its course. Upstream of Tottington Print Works was the Stormer Hill Bleach Works. The fouled water from this works was carried via a wooden trough alongside the Kirklees Brook to discharge at a point downstream of the intake for Tottington Print Works. A small supply of water was obtained from wells at Nabb's Farm and Nabb's Cottage, north of Shepherd Street. In addition, in very dry seasons, a system of using the cleanest of the fouled water was employed, with water being pumped up from the settling tanks to filters situated beyond the railway arches. By 1909, the effluent purifying plant at the print works comprised a series of nine stone-built settling tanks, an additional range of four stone-built settling tanks, and four cinder-bed filters.

4. ARCHAEOLOGICAL SURVEY

4.1 INTRODUCTION

- 4.1.1 The archaeological survey comprised a visual inspection and measured survey of the site to identify the location of upstanding structural elements of the former print works. These remains can be related to the buildings shown on the Ordnance Survey map of 1930 (Fig 8), and the early twentieth-century Inventory plans (Fig 9). For ease of description, the surveyed remains have been allocated gazetteer numbers that can be cross-referenced to the 1904 Valuation and Inventory (*Appendix 2*).

4.2 THE BUILDINGS

- 4.2.1 **Gas Retort House (1 and 1A):** this appears on the Ordnance Survey map of 1848 as a circular feature immediately to the north of Lodge 3. It is also shown on the subsequent edition of Ordnance Survey mapping, published in 1893 (Fig 3), which also annotates the position of a gasometer in the north-eastern part of the site. By 1904, the plant in the gas retort house comprised 13 fire clay gas retorts, which will presumably have supplied the gas required to illuminate the interiors of the various buildings, and for some of the machinery, such as that in the Gas Singeing Room.
- 4.2.2 Physical remains of the gas retort house include fragments of the southern wall of the building, and an intact basement. The surviving fabric of the southern wall is of built to course stone construction, and incorporates an aperture affording access to the basement (Plate 18).



Plate 18: Remains of the south wall of the Gas Retort House, and access to the basement

- 4.2.3 The basement beneath the gas retort house is accessed via the south wall of the building, and survives intact (Plate 19). The fabric of the structure comprises machine-pressed bricks, indicative of a construction date no earlier than the late nineteenth century. The ceiling incorporates wide brick arches springing from steel beams.



Plate 19: The Gas Retort House basement

- 4.2.4 Physical remains of the gasometer in the north-eastern part of the site are not clearly distinguishable, as the site is covered by an extensive deposit of what appears to be demolition debris. This has seemingly resulted in a raising of the ground level in that part of the site (Plate 20).



Plate 20: Probable demolition rubble on the site of the gasometer

- 4.2.5 **Printers' Shop (2):** this is shown on the Ordnance Survey map of 1848 (Fig 2), but appears to have been expanded by the time of the Ordnance Survey map of 1893. Physical remains of the building are not visible as above-ground features, although any surviving structures are likely to be obscured by the vegetation that covers the area. Similarly, there is little physical evidence for the former yard immediately to the east of the printers' shop, although several flagstones observed amongst the undergrowth in this area may represent *in-situ* remains of the yard surface.
- 4.2.6 **Smithy (3):** this first appears on the Ordnance Survey map of 1893 (Fig 3). Physical remains of the smithy include a section of the northern wall of the building, which survives to a maximum height of *c* 2m, and comprises built to course stone (Plate 21). This wall also formed a retaining wall for the reservoir to the north. The south-eastern corner of the smithy incorporates the remains of a brick-built structure, which probably represents the surviving elements of the chimney marked on the Valuation Plan of 1904.



Plate 21: The internal elevation of the north wall of the Smithy

- 4.2.7 **Mechanics' and Joiners' Shop (4):** situated immediately adjacent to the smithy (3), the mechanics' and joiners' shop formed the eastern end of this short building range. A structure in this position is shown on the Ordnance Survey map of 1848 (Fig 2), but appears to have been expanded and remodelled by the time of the Ordnance Survey map of 1893 (Fig 3). Physical remains of the building include the northern and western walls, which comprise built to course stone blocks, and survive to a height of 1.5m (Plate 22). The remains of internal stone-built structures are also visible, although the floor level is obscured entirely by vegetation.



Plate 22: The internal elevation of the north wall of the Mechanics' and Joiners' Shop

- 4.2.8 **Copper Roller House (5):** a small building is shown in this position on the Ordnance Survey map of 1848 (Fig 2), but this had been subsumed by a larger rectangular building by the time of the Ordnance Survey map of 1893 (Fig 3). This rectangular structure is identified as the copper roller house in the Valuation and Inventory of 1904. The southern wall of the building survives to a height of c 1.5m. The wall foundation comprises stone rubble, whilst the upper courses are of brick construction. Several sections of collapsed brick wall lie in the area immediately to the north which, together with vegetation, obscure from view any floor surfaces that might survive.



Plate 23: The southern wall of the Copper Roller Store

- 4.2.9 **Office and Store (6):** this appears on the Ordnance Survey map of 1848 (Fig 2). It is shown on the 1904 Valuation Plan as a small room forming the south-western end of a building range that lies adjacent to the Smithy and Mechanics' and Joiners' Shop. There are no visible above-ground remains of the building, although it seems likely that the foundations may be obscured beneath demolition rubble and vegetation.
- 4.2.10 **Engraving Room (7):** situated immediately to the north of the Office and Store (6), the Engraving Room was almost certainly of a contemporary construction. There are no visible above-ground remains of the building, although it seems likely that the foundations may be obscured beneath demolition rubble and vegetation.
- 4.2.11 **Roller Stores, Printing and Engraving Rooms (8 – 11):** this appears on the Ordnance Survey map of 1848, and forms part of the same building range as the Office and Store (6), the Engraving Room (7). However, physical remains of these rooms are visible above ground and include fragments of the north-western wall, which comprises coursed stone blocks and survives to a height of c 1.85m (Plate 24). The remains of internal partitions are also visible, but any surviving elements of floor surfaces are obscured beneath vegetation.



Plate 24: Remains of the Roller Stores, Printing and Engraving Rooms

- 4.2.12 **Economiser House (11A):** this small detached building lay between the Roller Printing and Engraving Room (10 and 11) and the Boiler House (13), and housed a Green's fuel economiser with 224 pipes, with a vertical steam engine to power the scrapers. There are no visible remains of this building, its site lying beneath the access road to the car-parking area by Island Lodge.

- 4.2.13 **Rag Store (11B):** this building was situated on the western side of the access road, forming the northern part of the print works complex, and contained ten cast-iron rag drying chests in 1904. The extant remains include fragments of the western and southern walls, which comprise built to course stone blocks, and survive to a maximum height of *c* 1.9m (Plate 25). The western wall is cut into the natural slope, and acts as an earth-retaining structure, although the central section has collapsed. The remains of any surviving elements of floor surfaces are sealed beneath demolition rubble and vegetation.



Plate 25: Remains of the Rag Store, looking south-west

- 4.2.14 **Boiler House, Drying and Store Rooms (12 - 13):** this building is shown on the Ordnance Survey map of 1848 (Fig 2), although is depicted as a wider structure on the subsequent edition of Ordnance Survey mapping, published in 1893 (Fig 3). The Valuation and Inventory for 1909 lists a wrought-iron Lancashire steam boiler (30ft long and 7ft diameter) on the ground floor, together with a steel Lancashire boiler, supplied by Wm Lord of Bury in 1890. The first floor was used as drying and store rooms, and was connected with the Printing Room (10) via a wooden gangway.
- 4.2.15 There are few above-ground remains of the building surviving. The most visible component is a large, vertical stone slab (Plate 26), the position of which corresponds to the northern wall of the Boiler House. The western side of the stone slab is abutted by a wall composed of refractory and machine-pressed bricks, which probably represent the vestiges of the housing for one of the boilers. This wall has been exposed by the erosion caused from the use of an informal path down the slope.



Plate 26: The site of the Boiler House

- 4.2.16 **Wash-up Room (14):** this building is shown on the Ordnance Survey map of 1848 (Fig 2), although is depicted as a wider structure on the Ordnance Survey map of 1893 (Fig 3). According to the Valuation and Inventory for 1909, the room housed two cast-iron wash-up cisterns, each measuring 6ft x 2ft 8in x 2in, and a wooden cistern. Situated between Boiler House **13** and Engine Room **15**, structural remains of this room are limited to a brick-built column, which is likely to have been an internal feature.
- 4.2.17 **Engine and Pump Cellar, Machine Printing Room, and Drying Room (15):** this building is shown on the Ordnance Survey map of 1848 (Fig 2), although it is depicted as a wider structure on the Ordnance Survey map of 1893 (Fig 3), suggesting that it had been remodelled or rebuilt during the second half of the nineteenth century. According to the Valuation and Inventory for 1909, the cellar under part of this room housed three horizontal steam engines for driving the printing machines in the room above.
- 4.2.18 Substantial remains of this building survive, including what appears to be the foundation bed for a large steam engine. This comprised three large, rectangular stone ashlar blocks, laid atop a substantial foundation of stone (Plate 27). The remains of a stone-built tank also survive immediately to the south of the stone foundation, perhaps representing one of the lead-lined steeping cisterns referred to in the Valuation and Inventory for 1909. Further substantial remains survive to the north. These comprise a wall composed of stone ashlars that survives to a height of c 2m, forming the eastern wall of a cellar structure (Plate 28). The roof of the cellar comprises a concrete raft that incorporates large fragments of crushed brick, consistent with a late nineteenth- or early twentieth-century construction date.



Plate 27: Stone ashlar blocks in Room 15



Plate 28: Substantial remains of Room 15

4.2.19 **Washing Place (16 and 19):** this building is shown on the Ordnance Survey map of 1848 (Fig 2), forming part of the mid-nineteenth-century print works complex. The rear, east-facing internal elevation of these buildings survives extant to a height of c 3m, forming a retaining wall for the eastern end of Lodge 3. The wall is of stone rubble construction with little indication for any coursing (Plate 29). The fabric incorporates several patches of machine-pressed bricks bonded with a dark grey, ash-based mortar, indicative of late nineteenth- or early twentieth-century repair work. The wall also incorporates a large aperture lined with refractory bricks, suggesting that it may have been intended as a flue. The position of this feature corresponds broadly with the corner of Rooms **16** and **19** shown on the Valuation and Inventory Plan of 1904. The well-preserved remains of the flagstone floor in Room **19** were exposed during the archaeological excavation (*Section 5.3 below*).



Plate 29: The western wall of Building **16/19**

4.2.20 In addition to the western wall, two large worked stone blocks and associated fragmentary brickwork situated in the eastern part of the building survive as internal features. These are likely to represent elements of a foundation bed for machinery or a small steam engine (Plate 30). The presence of these remains suggests that further buried remains will survive *in-situ*.



Plate 30: The probable foundation bed for a machine or small steam engine in Room 19

- 4.2.21 **Horizontal Engine House (18A):** according to the Valuation and Inventory for 1909, this room housed a horizontal triple expansion condensing steam engine. This had a 9in diameter high-pressure cylinder, 15in diameter intermediate cylinder, and a 23in diameter low pressure cylinder. A fragment of the eastern walls of this building is visible as an above-ground feature. The presence of these remains suggests that further buried remains of the engine house will survive *in-situ*.
- 4.2.22 **Dye House (20):** this building is shown on the Ordnance Survey map of 1848, forming part of the mid-nineteenth-century print works complex, although it is shown to have been expanded considerably on the Ordnance Survey map of 1893 (Fig 3). The Valuation and Inventory for 1909 lists the machinery in this room, which on the ground floor included an open dunging range that comprised five cast-iron cisterns (each measuring 28ft 4in x 4ft 10in x 5ft), fitted with 32 copper rollers and ten copper shell carrying bowls, supplied by John Wood of Ramsbottom. Other machinery included two 10ft flat washing machines, two second dunging machines, two wince dyeing machines, and a range of four wince dye becks, each measuring 12ft wide with cast-iron cisterns. The dye house also housed two soaping machines, each 10ft 6in wide, a washing-off machine, a range of five soaping machines (each 7ft wide), two cast-iron soap boiling cisterns on brick supports with flights of steps and stone landings, two flat washing machines, and a range of four wince dye becks, each 9ft wide with cast-iron cisterns.
- 4.2.23 Whilst there are no above-ground remains of the buildings' walls visible, the well-preserved remains of the flagstone floor, the foundation beds for the steam engine, and several other internal features were revealed during the excavation (*Section 5.3 below*).

- 4.2.24 **Dynamo House, Stentering Room, Winding-on and Marking Rooms (21):** the footprint of this building is marked on mid-nineteenth-century maps of the site. The ground floor is referred to as the Dynamo House in the Valuation and Inventory for 1909, although it was listed in 1904 as store room.
- 4.2.25 The north-western wall of Room **21** survives to a height of c 2.3m, forming a retaining wall for the southern side of Lodge 3. The fabric of the wall comprises built to course stone rubble, with the occasional use of slate (Plate 31). Much of the wall is obscured by vegetation, although a stone-blocked aperture, possibly representing a former doorway, is visible towards the southern end. It is probable that the well-preserved remains of the internal floor will survive as buried remains. Indeed, the top of a stone-built tank is visible just above the modern ground level, situated within the eastern part of the footprint of the room as depicted on the Valuation Plan of 1904 (Fig 9).
- 4.2.26 The location of the extant wall does not correspond closely with the north-western wall of Room **21**, as depicted on the Valuation Plan of 1904 (Fig 9). However, it is considered likely that this reflects an inaccuracy in the 1904 Plan, which does not appear to be a completely accurate measured survey of the buildings; it seems most unlikely that the extant wall represents a partition within the building.



Plate 31: The northern wall of Room 21

- 4.2.27 **Engine House, Piece Room and White Room (22):** adjoining Room **21**, Room **22** is shown on the Ordnance Survey map of 1848, forming part of the mid-nineteenth-century print works complex. By 1904, the ground floor of this room housed a high-pressure horizontal steam engine with a 15" cylinder. This powered a wrought-iron second-motion shaft, with a large spur and two bevels gears. The first floor was used as a piece room, and contained plaiting-down apparatus. The second floor was used as the white room.

- 4.2.28 The north-western wall of Room **22** survives to a height of *c* 2.2m, and comprises built to course stone rubble (Plate 32). The component stone blocks are slightly larger than those used in the construction of the adjacent Room **21**, suggesting that it may have been of a different phase of construction; Room **22** is also on a slightly different alignment. The wall incorporates regular apertures, each measuring some 1.25m wide, at *c* 2m intervals along its length (Plate 25). The size and form of these apertures is consistent with them having been intended as window apertures, although it is difficult to understand how these would have acted as such given the location of the Cartwheel Lodge immediately to the west. With these factors in mind, it is tempting to suggest that Room **22** were erected prior to the construction of Cartwheel Lodge in the 1820s (*Section 4.4.2 below*), and perhaps formed part of the documented corn mill or cotton mill complex. However, corroborating evidence is lacking, and remains an objective for future research.
- 4.2.29 All of the apertures in the wall were modified subsequent to their original construction. In two cases, this modification involved the insertion of brick-arched lintels, one of which comprised refractory bricks (Plate 33). It is uncertain whether this indicates that Room **22** housed high-temperatures processes.
- 4.2.30 The location of the extant wall does not correspond closely with the north-western wall of Room **21**, as depicted on the Valuation Plan of 1904 (Fig 9). However, it is considered likely that this reflects an inaccuracy in the 1904 Plan, which does not appear to be a completely accurate measured survey of the buildings.



Plate 32: The north-western wall of Room 22



Plate 33: A remodelled aperture in the north-western wall of Room 22

- 4.2.31 **Hanging Room (22A):** this room is absent from the Ordnance Survey map of 1848 (Fig 2), but is shown on the first edition 25" : 1 mile map of 1893 (Fig 3). It was built across the Kirklees Brook in the south-western corner of the print works complex, and was used as a hanging room, containing overhead wooden hanging rails. Elements of the north-west-facing elevation of this room survive extant on the western side of the Kirklees Brook. The fabric of the wall comprises coursed rubble, and survives to a height of *c* 2m.
- 4.2.32 A continuation of the same stone-built wall survives on the opposite side of the Kirklees Brook. This appeared to have been erected on top of an earlier stone-built wall that lines the channel of the brook (Plate 34).



Plate 34: The south-eastern wall of Room 22 situated on the eastern side of the Kirklees Brook

4.2.33 **Ageing Room (22B):** this room was erected during the first decade of the twentieth century, and is first shown cartographically on the Valuation Plan of 1909, subsuming a small ‘new dyeing room’ annotation on the Valuation Plan of 1904. In 1909, the first floor of Room **22B** contained two aniline agers, an ammonia ager, and a double vertical steam engine. The surviving fabric comprises two walls of machine-pressed bricks bonded with cement-based mortar, set partially on a foundation course of coursed stone rubble (Plate 35).



Plate 35: The extant remains of Room 22B

- 4.2.34 **Small Finishing Room (23):** situated in the southern part of the print works complex, Room **23** was constructed as part of an expansion of the site during the second half of the nineteenth century, and is first depicted on the Ordnance Survey map of 1893 (Fig 3). Amongst the machinery in this room listed in the Valuation and Inventory for 1909 are a two-bowl preparing mangle, a horizontal drying machine, a double diagonal steam engine with 7in cylinders, and a horizontal steam engine with a 5in cylinder to drive the soaping range in the Dye House (Room **20**). The first floor of this room was used as a steaming room, which contained a circular wrought-iron steaming chamber that extended outside the building.
- 4.2.35 The above-ground remains of the building include the southern wall, which was cut into the natural slope to the south, and survives to a height of *c* 1.7m. The wall is of coursed stone construction, and incorporates several features. These features seemingly include elements of a steam chest, which is annotated on the Valuation Plans of 1904 and 1909, but has been infilled with machine-pressed bricks (Plate 36).



Plate 36: The extant remains of Room 23

- 4.2.36 **Dye House Colour Store (24):** situated adjacent to Room **23** in the southern part of the print works complex, Room **24** similarly dates to the second half of the nineteenth century. By the early twentieth century, this room housed two eight gallon copper cavity colour pans with wrought-iron connecting piping, a cast-iron steam chest, and numerous small items of equipment. The surviving fabric visible above ground includes *in-situ* flagstones, almost certainly representing an interior floor (Plate 37), offering considerable potential for additional structural remains to survive beneath the undergrowth.



Plate 37: Flagstone floor within Room 24

- 4.2.37 **Stores (25):** situated on the south-eastern edge of the print works complex, occupying a site on the western bank of the Kinklees Brook, the footprint of the Stores is shown on the Ordnance Survey map of 1893 (Fig 3). The basement of this building housed a 4hp gas engine. The first floor was used as the copper roller store, and the second floor was used as a making-up warehouse. The eastern wall of the building, which forms a retaining wall for the channel of the Kinklees Brook survives intact.
- 4.2.38 **Drug Store (26):** erected across the Kinklees Brook in the south-eastern part of the site, the footprint of the Drug Store is absent from the Ordnance Survey map of 1893, but is shown on the Valuation Plan of 1904. This room housed two cast-iron colour grinding mills, and a Barford & Perkin's patent grinding mill. Elements of the eastern wall survive as above-ground features, separating the room from the New Fancy Dye House (29), although the section of the building's floor that spanned the Kinklees Brook has been removed.
- 4.2.39 **Colour Shop (27):** located immediately adjacent to the Drug Store (26), the footprint of the Colour Shop is similarly absent from the Ordnance Survey map of 1893, but is shown on the Valuation Plan of 1904. This room housed a range on eight copper-cased colour mixing pans, a range of six copper cavity colour pans, one ten gallon copper cavity colour pan, a cast-iron water cistern, two stone washing cisterns, a cast-iron washing cistern, and a sheet-iron gas-heated stove. Power was provided by a vertical steam engine with an 8in cylinder and 14in stroke.
- 4.2.40 The location of the Colour Shop is marked by a slightly raised area on the southern side of the track on the western side of the Kinklees Brook. The above-ground physical remains include two large stone blocks, set vertically and c 1.5m apart, seemingly representing a doorway through the western wall of the building from a yard area (Plate 38). Elements of the eastern wall also survive as above-ground features, separating the room from the New Fancy Dye House (29).



Plate 38: Stone blocks probably representing door jambs in the western wall of Room 27

4.2.41 **New Print Shop (28):** located between the Colour Shop (27) and the Grey Washing Room (33), this building is annotated on the Valuation Plan of 1904 as being ‘in the course of erection’, presumably representing the reconstruction of an earlier building that is depicted on the Ordnance Survey map of 1893 (Fig 3). The new building had evidently been completed by the time of the Valuation Plan of 1909 by which date, together with Room 33, it contained a range of colour-garment printing machinery on the ground floor. Power was provided by a pair of vertical steam engines with 6in cylinders, a pair of vertical steam engines with 7½in cylinders, a double vertical steam engine with two 8in cylinders, a double vertical steam engine with two 7½in cylinders, a double angular steam engine with two 14in cylinders, two double diagonal steam engines with 8in cylinders supplied by Mather & Platt Ltd, a three cylinder diagonal steam engine with 10in cylinders supplied by Rushfirth Brothers of Colne, a horizontal steam engine with 9in cylinders, and a double diagonal steam engine with 7in cylinders supplied by Walker of Radcliffe.

4.2.42 The northern and eastern parts of the New Print Shop were built over the Kirklees Brook, although the floors in these parts of the room have since been removed. The surviving above-ground remains include two large stone ashlar blocks (Plate 39), which almost certainly formed a foundation bed for one of the steam engines referred to in the Valuation and Inventory of 1909. The ashlar blocks are set on a wall of stone construction, which stands to a height of c 1.7m (Plate 40). The surface of other, smaller stone blocks are visible at ground level elsewhere within the footprint of this room, which probably represent the bases for the printing machines. It is most likely that elements of the floor will survive *in-situ* as buried remains.



Plate 39: Stone foundation blocks for a steam engine in the New Print Shop, looking north



Plate 40: Western stone foundation block for a steam engine in the New Print Shop

- 4.2.43 **New Fancy Dye House (29):** situated immediately to the east of the New Print Shop (28), Colour Shop (27) and Drug Store (26), the footprint of the New Fancy Dye House is absent from the Ordnance Survey map of 1893 (Fig 3), but is shown on the Valuation Plan of 1904. By that date, the room housed a clearing and drying range that comprised a two bowl chemic mangle, a horizontal drying machine, and a horizontal steam engine with a 6in cylinder and 12in stroke. It also contained an indigo dyeing range, which comprised four cast-iron cisterns and two wooden cisterns, a vertical drying machine, and an horizontal steam engine with a 7in cylinder and 12in stroke. It also housed a chemicing and drying range with a two bowl mangle, an horizontal drying machine, a ruby dyeing machine, and an horizontal steam engine with a 7in cylinder and 15in stroke, another horizontal steam engine, six dye jigs, a double diagonal steam engine, an indigo cutting and drying range that comprised a brass cistern, a cast-iron cistern, a two-bowl mangle, a vertical drying machine and an horizontal steam engine with an 8in cylinder and 14in stroke. Visible remains of the New Fancy Dye House include elements of the western, southern and eastern walls.
- 4.2.44 **Plaiting-down Room (31) and Steaming Room (32):** forming a short range of buildings built into the slope overlooking the Bleach Croft along the eastern boundary of the print works complex, the footprint of these rooms is absent from the Ordnance Survey map of 1893, but is shown on the Valuation Plan of 1904. By 1909, the Plaiting-down Room (31) housed two sets of plaiting-down apparatus, each 70in wide, two plaiting-down stillages, and an oblique high-pressure steam engine with a 6in cylinder and 10in stoke. The Steaming Room (32), situated immediately to the north, housed three circular wrought-iron steaming chambers. The remains of the room include a substantial wall of stone-rubble construction, which survives to a height of c 1.8m (Plate 41). It is abutted by a concrete structure, which probably represents part of the Steaming Room (32). The stone wall incorporates a significant bulge, implying that it is likely to collapse in the short- to medium-term.



Plate 41: Extant fabric of the Plaiting-down Room (31), looking north-east

- 4.2.45 **Grey Washing and Chemicing Room (33 – 34):** situated in the centre of the print works complex on the northern bank of the Kirklees Brook, this rectangular room lay within the footprint of the buildings depicted on the Ordnance Survey map of 1848 (Fig 2). It was seemingly remodelled between 1904 and 1909, as the southern wall that formed a partition with the New Print Shop (28) appears to have been replaced with a row of columns.
- 4.2.46 The principal extant remains in the footprint of the Grey Washing Room survive in the eastern part of the room. These include fragments of the eastern wall, forming a partition between the Print Room (43A), and the substantial foundation bed for a steam engine, situated on the northern bank of the Kirklees Brook (Plate 42). The foundation bed seemingly comprises two principal elements. The western part comprises four huge stone ashlar blocks, arranged in a square. All of the blocks contain vertical holes that were presumably intended to house metal tie-down rods. The eastern part of the foundation comprises a slab of concrete that incorporates a large proportion of brick fragments, indicative of late nineteenth- or early twentieth-century construction, possibly representing a remodelling of the power systems in this part of the print works. The ashlar blocks and the concrete slab are laid on a foundation composed largely of machine-made bricks, but also incorporate some small stone slabs.
- 4.2.47 This structure is likely to have formed the foundation bed for the vertical steam engine referred to in the Inventory of 1904. This engine had an 8in cylinder and 14in stroke, and provided power to a blanket washing machine with stone cistern, a four-hole dash wheel, and a flat washing machine for ‘reds, etc’ (M75/4/1/19).



Plate 42: The remains of the foundation bed for the steam engine in the Grey Room (33)

4.2.48 **Part of Finishing Room (36):** situated immediately to the west of the Bleach Croft (37 and 45), this room lay within the footprint of the mid-nineteenth-century print works (Fig 2). By the early twentieth century, the first-floor of this room contained a range of stretching machines and calenders, powered by a double diagonal steam engine with two 10in cylinders. The Valuation and Inventory for 1909 notes that this engine had an ‘ashlar foundation’, which probably correspond to the substantial remains that survive within the footprint of this room. This comprises two large stone ashlar blocks mounted atop a large base that is composed of built to course stone blocks, which have seemingly been re-pointed with cement-based mortar. The engine foundation survives to a height of c 2.4m (Plate 43).



Plate 43: The remains of the foundation bed for a steam engine in Room 36

4.2.49 **Bleach Croft (37, 45 and 46):** situated within the footprint of the mid-nineteenth-century print works, the Bleach Croft occupied relatively level land, the northern part of which had probably been terraced into the natural slope. By the early twentieth century, the ground floor of the Bleach Croft (Rooms 37 and 45) contained a stone chemic cistern measuring 5ft x 4ft x 4ft (1.52 x 1.22 x 1.22m), four stone steeping cisterns set in the floor, each measuring 8ft x 7ft x 5ft (2.44 x 2.13 x 1.52m), a horizontal steam engine with a 6in cylinder, a cast-iron cistern measuring 3ft 6in x 2ft 9in x 2ft 9in, a chemicing machine, a washing machine, an 8ft (2.44m) wide souring machine with a stone cistern, a liming machine, a stone lime cistern in two compartments, two wrought-iron high-pressure liming kiers, each 8ft diameter and 8ft deep, and two circular wrought-iron cloth bines, each 7ft 10in diameter and 6ft 6in deep with wooden linings. The ground floor of Room 46 housed a washing machine for ‘dirty greys’, two 8ft wide washing machines with stone cisterns, and a squeezer with one brass and two wooden bowls.

- 4.2.50 The footprint of the Bleach Croft was targeted by the archaeological excavation. This demonstrated that extensive and well-preserved remains of the room survived *in-situ* at a shallow depth below the modern ground surface. These remains included large elements of the flagstone flooring, several stone cisterns, the two circular wrought-iron cloth bines, and other structural features (Section 5.2 below).
- 4.2.51 ***Finishing and Piece Rooms (38 – 41 and 47):*** situated to the north-west of the Bleach Croft, within the footprint of the mid-nineteenth-century print works. The surviving remains occupy the higher ground overlooking the Bleach Croft, although are largely obscured by vegetation. However, the remains of flagstone flooring, large stone blocks containing metal tie-down bolts indicative of their use as machine beds, and the footings of a square structure composed of machine-pressed bricks are clearly visible in Room 47 (Plate 44). Within the footprint of Room 40, situated immediately to the south, are the remains of a large stone-built structure, which may have formed the foundation bed for a steam engine.



Plate 44: The remains of flagstone flooring and a brick-built foundation in Room 47

- 4.2.52 ***Cylinder Drying Rooms, Fancy Dye House, Print Room and Chemic Shed (43 – 43D):*** this group of buildings, together with the New Fancy Dye House (29), form the south-eastern boundary of the print works complex. Occupying the higher ground overlooking the Bleach Croft, the footprint of some of these buildings (43 and 43A) are depicted on the Ordnance Survey map of 1893 (Fig 3), whilst the Winding-on Room (43C), and the adjacent Plaiting-down Room (31) and Steaming Room (32), are first shown on the Valuation Plan of 1904. These were erected immediately to the east of the earlier buildings, forming a U-shaped plan that encompassed a small central yard and the Chemic Shed (43B). By the early twentieth century, the Cylinder Drying Rooms and Fancy

Dye House (30) housed two chroming, developing and drying ranges, a vertical steam engine with a 12in cylinder and 12in stroke, a vertical steam engine with a 6in cylinder and 12in stroke, a two bowl 'blueing' mangle, and two horizontal drying machines. Situated immediately to the south, the ground floor of the Print Room (43A) housed a flat cast-iron steam chest and numerous small items of equipment. The Chemic Shed (43B) housed a stone chemic-mixing cistern measuring 14ft x 3ft 10in, and 5ft 6in deep.

- 4.2.53 The above-ground remains of this range of buildings include the stone-built partition wall between the Cylinder Drying Room (43) and the Winding-on Room (43C), which survive to a height of *c* 1.6m. The most substantial remains, however, are situated within the footprint of the Chemic Mixing Shed (43B), and comprise the large and intact chemic-mixing cistern (Plate 45), divided internally into two compartments. The north-west/south-east-aligned cistern is placed on a large stone slab foundation, which lies atop two parallel walls composed of machine-pressed bricks. The component stone slabs of the cistern are held together with two iron rods at the top and bottom of each of the long sides (Plate 45). An iron plate near the base of the stone slab forming the south-eastern end of the cistern almost certainly represents a mechanism for draining the cistern.



Plate 45: The chemic-mixing cistern in the Chemic Shed 43B

- 4.2.54 The remains of a built to course stone wall survives a short distance to the east of the stone chemic-mixing cistern. The wall is aligned broadly east/west, and survives to a height of *c* 1.3m. This may have acted as a retaining wall for the small yard adjacent to the Chemic Mixing Shed (43B).

4.2.55 **Kier House (44 and 44A):** forming part of the mid-nineteenth-century print works, the Kier House lies in the eastern part of the site, adjacent to the Bleach Croft. By the early twentieth century, the machinery in this room included five wrought-iron high-pressure boiling kiers, each of 8ft (2.44m) diameter. The surviving above-ground fabric of the Kier House includes the northern wall, which survives to a height in excess of 3m, and comprises coursed stone blocks (Plate 46). Based on the results obtained from the excavation of the Bleach Croft (*Section 5.2 below*), it is most likely that flooring and other internal features of the Kier House will survive *in-situ* as buried remains.



Plate 46: A section of the north wall of Kier House (44), looking north-east

- 4.2.56 **Stentering Room (46B and 48A):** situated on the higher ground to the north of the Bleach Croft and Kier House, the footprint of the Stentering Room is depicted on the Ordnance Survey map of 1893 (Fig 3). It appears from the detail provided by the Valuation Plans to have been extended slightly between 1904 and 1909, by which date it housed an horizontal steam engine and a double diagonal steam engine that powered a two-bowl mangle, a set of four copper drying cylinders and a set of three copper drying cylinders, a self-clip hot-air jigging stentering machine, and a tubular heater.
- 4.2.57 The remains of the Stentering Room (48A) include the eastern and southern walls. The short eastern wall survives to a height of c 2m, and is of coursed stone construction (Plate 47). In contrast, the southern wall of the building, forming a partition between Room 46B, is of brick construction, presumably representing a remodelling episode.



Plate 47: The south-eastern end of the Stentering Room (48A)

- 4.2.58 **Boiler House and Grey Room (51 and 52):** the footprint of the Boiler House is shown on the Ordnance Survey map of 1893, subsuming a narrower building depicted on the Ordnance Survey map of 1848. By 1909, the Boiler Room housed six boilers, supplied between 1892 and 1904, and two economisers. Physical remains of the Boiler House and Grey Room are not easily visible as above-ground features.
- 4.2.59 **Roller and Mill Turning Rooms (58 and 63):** this building is first shown on the Ordnance Survey map of 1893, forming the north-western part of the print works. Physical remains of these rooms comprise substantial fragments of stone walling (Plate 48).



Plate 48: Remains of the Roller and Mill Turning Rooms (58A and 63)

4.3 OTHER BUILDINGS

- 4.3.1 **Mill Street Houses:** a row of cottages is marked on the tithe map of 1842 and the sequence of Ordnance Survey maps from 1848 to 1930 (Figs 2-5), but are absent from the Ordnance Survey map of 1954 and 1960 (Fig 6), suggesting that they had been demolished by that date. The cottages are itemised in the Valuation and Inventory for 1904, which refers to their location ‘within the Works’ Yard known as Kiln Hillock’ (M75/4/1/19). The last block of the cottages comprised a fire engine house and storeroom (*ibid*). The above-ground remains include the foundations of the north-western end of the cottages, comprising two courses of hand-made bricks (Plate 49).



Plate 49: Foundations of the cottages on Mill Street, looking north-west

- 4.3.2 **Mill House Row:** another row of cottages on the north side of Shepherd Street is shown on the tithe map of 1842 (Plot 736) and the sequence of Ordnance Survey maps from 1848 to 1930 (Figs 2-5), but are absent from the Ordnance Survey map of 1954. One of the cottages was occupied in 1842 by Robert Howarth, the foreman machine printer (*Section 3.3.11 above*), suggesting that these houses may have been reserved for key staff at the print works. The cottages ‘consisted of one room up, one down, and a small pantry’ (Rooney 1947, 1). The cottages are itemised in the Valuation and Inventory for 1904, which refers to ‘five cottages known as Mill Houses’ (M75/4/1/19). However, the site is occupied presently by a modern single-storey building, with no physical evidence for the former cottages surviving.
- 4.3.3 **Shepherd Street:** the Valuation and Inventory for 1909 itemises as part of the print works four cottages in Shepherd Street, with an adjoining barn. However, the Census Returns for 1891 (RG12/3352) show that the occupants of Shepherds Row were engaged in a variety of employment, including a cotton weaver, a woollen mill hand, a plate-layer on the railway, a cotton dyers assistant, a domestic servant, a farm labourer, and an agricultural labourer.

4.4 THE RESERVOIRS, WEIRS AND CULVERT

- 4.4.1 **Island Lodge:** known locally as Island Lodge, but also referred to as Scholes' Reservoir, this large reservoir is shown on Yates' map of 1786, and is likely to have been the site of the mill pond for the corn mill referred to in historical documents. It is shown on a plan of 1810 to have occupied the central and north-western third of the present lodge (UMAU 1996, 7), whilst the tithe map of 1842 show it to have been enlarged, covering some 12,460 square metres. This enlargement was presumably required to serve the print works in the early 1820s. In the bank at the north-west corner is a stone-built culvert, which contains a central partition, dividing the culvert channel into two.
- 4.4.2 **Cartwheel Lodge:** this lies immediately to the east of Island Lodge, and was probably created in the early 1820s to serve the print works. It is shown on the tithe map of 1842 and the Ordnance Survey map of 1848, and survives in this form. The reservoir covers an area of some 2306 square metres (Plate 50).



Plate 50: View across the Cartwheel Lodge, looking south

- 4.4.3 **Lodge 3:** a small reservoir situated immediately to the north-east of Cartwheel Lodge, and probably of a contemporary date. It is shown on the tithe map of 1842 and the Ordnance Survey maps of 1848 and 1893. On the Ordnance Survey map of 1907, however, a north-west/south-east-aligned building is shown to have been erected across its north-eastern part. This building and the reservoir is absent from the Ordnance Survey map of 1954, although this appears to be an error in the mapping rather than indicating that reservoir had been infilled. The reservoir covers an area of some 2306 square metres, and has recently been cleaned out and converted for use as a dipping pond (Plate 51). This revealed the historic fabric of the reservoir, which comprises coursed stone blocks. The remains of a sluice mechanism were also exposed at the north-eastern end of the reservoir.



Plate 51: Lodge No 3, looking north-east during its conversion to a dipping pond

- 4.4.4 **Lodge 4:** a small reservoir situated immediately to the south of Cartwheel Lodge, and first depicted on the Ordnance Survey map of 1893. It is of stone construction, and retains an iron sluice mechanism on its eastern side that presumably facilitated the draining of water into the Kirklees Brook. The lodge is filled with water, and covers an area of some 420 square metres (Plate 52).



Plate 52: Lodge No 4, looking north-east

4.4.5 **Lodge No 5:** known locally as Fireman's Lodge, this sub-rectangular reservoir occupied an elevated position in the north-western part of the mill complex, and was probably created in the early 1820s to serve the print works. It is shown on the tithe map of 1842 and the sequence of Ordnance Survey maps from 1848 to 1982, although it was probably infilled during the demolition of the engraving shops during the 1940s. It covered an area of some 615 square metres, which is represented presently by a raised bank, standing to a height of *c* 2m (Plate 53). The south-east-facing side of the bank retains a stone-built revetment wall, which is largely obscured by vegetation (Plate 54).



Plate 53: The raised bank of the infilled Lodge No 5, looking north-east



Plate 54: A section of the stone-built revetment wall for Lodge No 5, looking north-west

- 4.4.6 **Lodge No 6:** an oval-shaped reservoir situated on the eastern side of the Kirklees Brook in the southern part of the mill complex. The reservoir is first depicted on the Ordnance Survey map of 1893, covering an area of some 390 square metres.
- 4.4.7 Lodge No 6 survives as a water-filled reservoir occupying a raised bank that lies some 10m above the level of the Kirklees Brook. The lodge is encompassed by undergrowth, which obscures any historic fabric. However, a stone-built revetment wall around the northern and western sides of the reservoir is visible to a height of c 1m (Plates 55 and 56).



Plate 55: Lodge No 6, looking north-east



Plate 56: The revetment wall along the northern side of Lodge No 6, looking south-east

- 4.4.8 **Lodge No 7:** a sub-rectangular reservoir situated immediately to the south of Lodge No 6. It is first shown clearly on the Ordnance Survey map of 1907, although earthworks corresponding to the footprint of the reservoir are depicted on the Ordnance Survey map of 1893, suggesting that its construction may be broadly contemporary with Lodge No 6. The reservoir covers an area of some 340 square metres.
- 4.4.9 The site of Lodge No 7 is represented by a large and deep depression in the raised bank above the eastern bank of the Kirklees Brook. It is situated at a slightly higher level than Lodge No 6, which lies immediately to the north, and may have acted as a feeder. Notwithstanding the fairly dense covering of undergrowth across the area, the only visible structural elements comprise a stone-built revetment that survives to a height of approximately 3m on the western side of the reservoir, and a c 1.75m high revetment at the northern end.
- 4.4.10 **Lodge No 8:** two small, square-shaped reservoirs situated adjacent to the south-east corner of the Bleach Croft, depicted on the Ordnance Survey map of 1893. Each covered an area of some 60 square metres. The reservoirs are shown on the subsequent edition of Ordnance Survey mapping, published in 1907, to have been subsumed by an expansion of the mill buildings. No visible remains of these reservoirs survive.
- 4.4.11 **Lodge No 9:** a linear reservoir first depicted on the Ordnance Survey map of 1893 in the south-eastern part of the mill complex, occupying a site on the western side of the Kirklees Brook, and covering an area of some 975 square metres (Plate 57). It survives as a water-filled reservoir occupying the high ground above the western bank of the Kirklees Brook. The structure is of coursed stone construction.



Plate 57: Lodge No 9, looking north

- 4.4.12 **Weir No 1:** a stone-built weir across the Kirklees Brook immediately to the south of Lodge No 4. The weir does not appear to be shown on the Ordnance Survey map of 1848, and its site is marked as a footbridge of the 1893 map. It is, however, annotated as a weir on the Ordnance Survey map of 1907, suggesting that it may have been constructed during the early twentieth century.
- 4.4.13 The weir survives *in-situ*, and comprises coursed stone blocks that form a very slightly curved structure (Plate 58). The weir appears to abut the stone-built retaining wall forming the eastern bank of the watercourse in this location, further suggesting that the weir is a later addition.
- 4.4.14 **Weir No 2:** a weir situated a short distance downstream of Weir No 1, and first depicted cartographically on the Ordnance Survey map of 1922. The weir lies adjacent to Lodge No 7, and may have been intended as a spillway mechanism for the reservoir.
- 4.4.15 **Weir No 3:** this weir was built across a sharp bend in the Kirklees Brook, immediately to the south of the filter beds in the south-eastern part of the mill complex. The weir is marked on the Ordnance Survey map of 1848, and may be associated with the early development of the print works.
- 4.4.16 The weir survives *in-situ*, and comprises coursed stone blocks forming a slightly curved structure that stands to a height of approximately 1.8m (Plate 59). The southern end of the weir is keyed into a stone-built retaining wall that formed the southern edge of the watercourse. However, the course of the brook has been altered in this location, with the watercourse taking a route slightly to the north. Consequently, the brook no longer flows over the weir, which survives as an isolated structure.
- 4.4.17 **Weir No 4:** a weir situated a short distance downstream from Weir No 3. It first appears cartographically on the Ordnance Survey map of 1907, and may have been associated with the construction of the filter beds in this part of the mill complex. No visible remains of this weir survive.



Plate 58: Weir No 1, looking south



Plate 59: Weir No 3, and the old bed of the Kirklees Brook

4.4.18 ***The Culvert and River Channel:*** the development of the culvert through the centre of the print works site can be ascribed through the sequence of historical mapping to three phases. The Ordnance Survey map of 1848 shows the culvert to have been just 12m long, extending beneath the floor of one of the principal mill blocks. By 1893, the culvert had been extended considerably to allow an expansion of the floor space in the mill, providing a total length of approximately 102m. Further additions to the mill by 1907 demanded another 32m extension to the culvert at its south-eastern end, resulting in a total length of approximately 134m. Sections of the culvert have been removed subsequently, with a length of *c* 43.8m surviving intact. This section comprises squared stone blocks, forming an arched structure with an apex *c* 1.1m above the bed of the Kirklees Brook (Plates 60 and 61).



Plate 60: The western (upstream) end of the culvert



Plate 61: The eastern (downstream) end of the culvert

4.4.19 Downstream of the extant culvert, the course of the Kirklees Brook sweeps southwards through the footprint of the New Print Shop (28), the Colour Shop (27) and the Drug Store (26). Whilst the brook is no longer enclosed through this section, the sides of the channel are lined by stone walling (Plates 62 and 63). Sections of the walling are in a very poor condition, and the bed of the stream contains numerous stone blocks that represent collapsed walls. Elements of the demolished buildings, including fragments of flagstones and stone ashlars that almost certainly formed machine beds, are also visible on the stream bed.



Plate 62: The course of the brook through the footprint of the New Print Shop



Plate 63: The course of the brook through the footprint of the Colour Shop

- 4.4.20 Situated on the eastern side of the Kirklees Brook in the south-eastern part of the site is the effluent purifying plant, where foul water discharged from the print works was treated prior to being returned to the watercourse. The effluent was channelled to the purifying plant via a brick-built and concrete-capped culvert, the remains of which survive (Plate 64). The culvert is some 0.75m deep and 0.9m wide.
- 4.4.21 The remains of the purifying plant comprise a series of brick-built settling tanks and cinder-bed filters. These settling tanks survive in good condition, with the walls surviving to a height in excess of 2.5m (Plate 65).



Plate 64: Remains of the culvert leading to the filter beds



Plate 65: The filter beds adjacent to the Kirklees Brook in the south-eastern part of the site

4.5 ACCESS TRACKS, BOUNDARY WALLS AND RAILWAYS

- 4.5.1 The site of Tottington Mill is accessed via several tracks and lanes. The principal route is from the north via Shepherd Street, which itself is a lane of some antiquity, having formed part of one of the two pre-turnpike roads between Holcombe and Bury. The access to the print works is afforded via a track that leaves Shepherd Street at Tower Farm, and continues down the slope of the valley for the Kirklees Brook. Upon entering the print works complex, the track passed by an overhead wagon shed (**51A**) attached to the boiler house (**51**), beneath an overhead gangway (**51B**) that connected the boiler house to the machine printing shop (**15**), across a short yard and through a covered entrance (**18** and **35**) to the enter the mill yard, before crossing the route of the Kirklees Brook and continuing southwards as Mill Lane (*Section 4.5.4 below*).
- 4.5.2 Whilst the buildings that flanked the route have been demolished, the track between Shepherd Street and the print works retains large sections of historic surfacing, which probably date to the later nineteenth century. This surfacing comprises rectangular stone setts which, for the most part, survive in good condition, although small areas have been disturbed (Plate 66). The surface also incorporates some large stone slabs, situated in the location of the former yard between the gangway **51B** and covered entrance beneath the Sample Room and White Room **35** (Plate 66).



Plate 66: Looking north-west across the short yard adjacent to the machine shop (on the left), and up the entrance track towards Tower Farm and Shepherd Street

- 4.5.3 The western boundary of the mill complex is represented by the fragmentary remains of a stone-built wall and a stone gate post on the southern side of the track annotated as Mill Street on the Ordnance Survey map of 1893. The wall is of dry-stone construction, and survives to a height of *c* 1m (Plate 67). Large sections of Mill Street through this part of the site are surfaced with stone setts of a probable late nineteenth- or early twentieth-century date (Plate 68).



Plate 67: Fragments of the boundary wall at the western end of the site, looking north



Plate 68: Mill Street and gatepost at the western boundary of the site, looking east

- 4.5.4 The approach to the mill from the south-east was historically via Mill Lane. The boundary of the print works complex in this area appears to be marked by a stone gatepost (Plate 69), situated at the junction of Mill Lane and a footpath that branches off to the south-east, passing between Lodge No 9 and the western bank of the Kirklees Brook. The gatepost stands to a height of *c* 1.4m, and retains iron fittings, presumably representing hinge furniture. A stone-built retaining wall, standing to a height of *c* 1.5m, survives along the western side of Mill Lane (Plate 70).



Plate 69: The gatepost at the southern boundary of the site, looking south



Plate 70: The retaining wall along the western side of Mill Lane at the southern end of the site

- 4.5.5 In addition to the main access routes, a north-east/south-west-aligned track survives in the western part of the site, climbing the slope from Mill Street to the eastern end of Lodge No 5, and passing to the rear of the smithy, mechanics' shop and the printing and engraving rooms. The track is some 2m wide, and rises at an angle of approximately 30 degrees (Plate 71).



Plate 71: The track affording access to the eastern end of Lodge No 5 (Fireman's Lodge)

- 4.5.6 **The Railway:** the Bury and Tottington District Railway was authorised in 1877, and its construction commenced the following year (*Section 3.5.20 above*). The print works was accessed via a short private branch known as Knowles Sidings, which approached the site from the north. The Ordnance Survey map of 1893 (Fig 3) shows the line terminating at the overhead wagon shed (**51A**), adjacent to the boiler house (**51**) in the northern part of the site. By 1907, a further line had been laid to the gas retort house (**1**) at the western end of the site. Physical remains of the railway infrastructure are represented by a raised bank that lies adjacent to the modern footpath that accesses the site from the north.

5. ARCHAEOLOGICAL EXCAVATION

5.1 INTRODUCTION

- 5.1.1 The archaeological excavation was focused on two areas: a large area within the footprint of the Bleach Croft (Plate 72); and a small area in the Dye House. In both cases, excavation comprised the clearance of vegetation, overburden and demolition rubble, to reveal the upper surface of structural remains. These were left *in-situ*, and thus the exposed remains almost certainly represent the latest phase in the development of the works.



Plate 72: The site of the Bleach Croft prior to clearance and excavation works

5.2 THE BLEACH CROFT

- 5.2.1 The principal area of excavation focused on the footprint of the Bleach Croft, which was one of the largest rooms in the print works. An area measuring some 245 square metres was exposed (Fig 10), the southern part of which lay within the footprint of the building shown on the Ordnance Survey map of 1848 (Fig 2), whilst the northern part was within the later nineteenth-century extension to the works. The area of excavation examined elements of Rooms **33**, **45** and **46** shown on the Valuation and Inventory Plan of 1904 (Fig 9).
- 5.2.2 The floor of the Bleach Croft comprised for the most part large stone flags (**101**), which were of various sizes although, on average, measured 0.9 x 0.75m. These were exposed at a depth of 0.4m along the western part of the building, and 0.15m along the eastern side. In some places, the flagstones had subsided, presumably marking the position of below-floor culverts. Set flush with the flagstones across the floor in several places were large stone blocks

that incorporated vertical metal bolts, marking the positions of small engines. Several small areas of the floor had been subject to localised repair work, represented by patches of brick (**102**). These largely comprised hand-made bricks.

- 5.2.3 The tops of two large circular iron cisterns (**103** and **104**) were exposed along the eastern edge of the excavated area (Plate 73), within Room **45** as shown on the Valuation and Inventory Plan of 1904 (Fig 9). These almost certainly represented the remains of the two ‘circular wrought-iron cloth bines’ referred to in the Inventory (*Section 3.6.6 above*). The depth of the cisterns was not established, although the Inventory states that they were 6ft 6in (1.98m) deep with wooden linings. Both cisterns had a diameter of 2.40m, and had been sunk into the floor of the Bleach Croft. They were filled with mixed demolition rubble, comprising stone rubble, fragments of brick and slate, in a matrix of topsoil. Whilst the date at which these cisterns were installed remains uncertain, they lay within the footprint of the mid-nineteenth-century Bleach Croft.



Plate 73: Wrought-iron cistern **103** in the eastern part of the excavated area

- 5.2.4 Other structural remains that lay within the footprint of the building depicted on the Ordnance Survey map of 1848 included several substantial stone-built tanks, or cisterns (**105**, **121**, **123**, **129** and **130**), set within the floor of the Bleach Croft. It is possible, however, that at least some of these cisterns were installed during the later nineteenth century, replacing earlier equipment.

- 5.2.5 Rectangular cistern **105**, situated a short distance to the west of cistern **103**, adjacent to the eastern edge of Room **37** as shown on the Valuation and Inventory Plan of 1904 (Fig 9). It was aligned north/south, measured 2.06 x 1.24m, and comprised four huge stone blocks, each 0.17m thick, braced by an iron bar at each end (Plate 74). The cistern stood to a height of 0.6m above the floor, with its base set below the level of the floor. The sides of the cistern were not vertical, but tapered inward slightly.



Plate 74: Stone cistern **105**, lying a short distance to the west of cast-iron cistern **103**

- 5.2.6 A 0.24m wide cut-out, 0.15m deep, in the north-eastern corner of the cistern is likely to have been associated with the power transmission for a machine set over the cistern; the stone base (**106**) for a machine was set in the floor against cistern **105** in this location. Machine base **106** comprised a single stone block, measuring 1.25 x 0.54m, with the remains of at least three metal tie-down bolts visible on its upper surface. The position of other bolts may have been represented by splashes of molten lead that survived on the surface of the stone block. Other machine bases (**107** - **109**) were situated against the other three corners of the cistern (Fig 10). These were all of similar dimensions, and all contained metal tie-down bolts. It is possible that these bases formed a foundation for the 8ft wide (2.44m) souring machine, with an associated stone cistern, referred to in the Inventory (*Section 3.6.6 above*).
- 5.2.7 Situated immediately to the south of machine bed **106** was a vertical drain (**110**). This comprised a vertical ceramic pipe, of 0.31m diameter, set into the floor of the Bleach Croft within a housing of machine-pressed bricks. Drain **110** is likely to represent a late nineteenth- or early twentieth-century modification to the drainage system. On the southern side of the drain **110** was a Bakerlite-type pipe (**111**), cut through the flagstone floor of the Bleach Croft. This possibly represented a feed pipe to cistern **105**.

5.2.8 Stone cistern **112** was in line with cistern **105**, occupying the north-eastern part of the excavated area (Fig 10), within the footprint of Room **45** shown on the Valuation and Inventory Plan of 1904 (Fig 9). This was of similar construction, although the top of the cistern was flush with the flagstone floor. The cistern measured 2.70 x 1.26m, with the stone slabs forming the sides of the cistern each measuring 0.17m thick (Plate 75). This cistern also had two cut-outs along its eastern side, with a single larger, 0.38m wide cut-out on its western side. Unlike cistern **105**, **112** only had two machine bases, one (**113**) situated adjacent to its south-western corner, and a second (**114**) along its southern side. Base **113** comprised a stone slab measuring 0.78 x 0.64m, and retained two metal tie-down bolts. It was abutted on its northern side by a small L-shaped surface of machine-pressed bricks (**115**), some bearing the 'Tomlinsons plastics' stamp. A brick-lined drain (**120**), measuring 0.66 x 0.33m, survived immediately to the east of the cistern. Drain **120** was not excavated, although it presumably connected with the drainage system beneath the floor of the Bleach Croft.



Plate 75: Stone cistern 112 and associated machine base, with wall 116 in the foreground

5.2.9 Machine base **114**, measuring 2.48 x 0.38m, comprised a stone slab along the southern edge of cistern **112** (Plate 75). It retained four metal tie-down bolts, with a socket representing the housing for a fifth. Machine base **114**, and brick surface **115**, abutted the remains of a north/south-aligned wall (**116**), composed of coursed stone rubble bonded in a lime-based mortar. Wall **116** was 0.5m wide, and was exposed for a length of 3.4m (Fig 10). It survived to a maximum height of 0.44m above the floor of the Bleach Croft. The position of wall **116** corresponds with the partition separating Rooms **45** and **46**, as depicted on the Valuation and Inventory Plan of 1904 (Fig 9). The floor level to the west of wall **116** (Room **46**) was at a higher level than that to the east (Room **45**).

- 5.2.10 The western elevation of wall **116** was abutted by a square structure (**117**), which lay within the footprint of Room **46** as shown on the Valuation and Inventory Plan of 1904 (Fig 9). Structure **117** measured 1.6 x 1.6m, and survived to a height of 0.5m above floor level. The edges of structure **117** was composed of bricks, which included hand-made and machine-pressed variants, bonded in a dark-grey mortar, indicative of a late nineteenth- or early twentieth-century construction date. The central part of structure **117** comprised a large stone block measuring 1.28 x 1.04m, and retaining at least three iron bolts on its upper surface. The stone component was possibly earlier nineteenth-century fabric, with the bricks representing a later modification.
- 5.2.11 Situated to the north of structure **117** was another stone cistern (**118**), which similarly lay in the eastern part of Room **46** (Fig 9). This measured 1.55 x 1.18m, and protruded approximately 0.2m above the floor surface (Plate 76). Unlike the other cisterns, **118** had been worked from a single block of stone, although the vertical sides were similarly 0.17m thick. The cistern was excavated to a depth of 0.7m, although the base was not exposed. Semi-circular cut-outs, 0.14m wide, in the northern and southern sides of the cistern were almost certainly associated with the power transmission to a machine that had been situated over the cistern. The western side of the cistern was abutted by a large stone slab (**119**), which measured 1.70 x 0.5m, retained two metal tie-down bolts, indicating its intended use as a machine base.



Plate 76: Stone cistern **118** and associated machine bed **119**, looking east

- 5.2.12 Situated c 1.75m to the west of cistern **118** was cistern **121** (Fig 10). This was slightly larger than cistern **118**, measuring 2.75m long and 1.24m wide across its top (Plate 77). However, the sides of the cistern tapered inwards, providing a width of 0.67m at its base; it was excavated to a depth of 1.4m, and whilst the base was not exposed, the top of a vertical drain at the southern end indicated that the floor level was close. Cistern **121** comprised four large stone

slabs, each 0.13m thick, held together with iron tie bars at each end. The upper surfaces of the component slabs were damaged slightly, although two semi-circular cut-outs in the eastern slab could be discerned. Stone blocks at each corner of the cistern, set flush with the flagstone floor, retained metal tie-down bolts for a machine that had probably been placed over the cistern.

- 5.2.13 Cistern **121** appeared to have been placed in a 1.48m wide 'trench' constructed north/south across this floor in this part of the Bleach Croft; the base of this trench was not exposed. In addition to cistern **121**, the trench also housed another stone cistern (**122**), situated 1.48m to the north. This similarly comprised four large stone slabs, each 0.13m thick, forming a tank that was 1.14m wide at its top. The cistern was not excavated, and its full length was not exposed, although it seemed that the sides tapered inwards like cistern **121**.



Plate 77: Cistern **121**, looking south

- 5.2.14 Two more stone cisterns (**123** and **124**) were exposed in the south-western part of the excavated area, in the footprint of Room **37** (Fig 9). Cistern **123** was aligned north/south, measured 2.75m long and 1.24m wide across its top, with sides that tapered inwards. It comprised four stone slabs, each 0.13m thick, tied together with iron bars at each end. The upper surfaces of the stone slabs were damaged slightly, although there appeared to be the remains of two semi-circular cut-outs at the northern end.
- 5.2.15 Cistern **124** was situated 1.02m to the west of cistern **123** (Fig 10) and was aligned east/west across the centre of Room **37** (Fig 9). It measured 2.12 x 1.24m, and similarly comprised four stone slabs, each 0.13m thick, tied together with iron bars at each end (Plate 78). This tank had no visible remains of any cut-outs, although there was a stone block situated at each corner of the tank, each retaining metal tie-down bolts. The tops of these stone blocks were 0.38m above the flagstone floor, with their bases sunk through the floor. In addition, the southern side of the tank had two 0.04m diameter circular holes drilled through it, which are likely to have been for a machine. It is possible that cistern **124** represented the stone chemic cistern referred to in the Inventory of 1904 (*Section 3.6.6 above*).



Plate 78: Cistern 124, looking south-west

- 5.2.16 Situated *c* 0.8m to the west of cistern **124** was a large stone block (**125**), measuring 1.38 x 1.20 x 0.46m, which had seemingly been placed on top of the flagstone floor (Fig 10). This retained several iron bolts and two cut-outs for an engine flywheel, indicating that this had been the base for a small steam engine. Abutting the eastern side of block **125** was a stone slab at floor level (**126**). This similarly retained metal tie-down bolts, and probably formed part of the housing for the same steam engine.

- 5.2.17 A square stone block (**127**), measuring 0.9 x 0.9m situated a short distance to the south of cistern **124** comprised two stones held together with iron strapping. The remains of a cast-iron pipe of 0.14m diameter survived in the centre of the blocks. Block **127** had been set into the floor of the Bleach Croft, but stood to a height of 0.26m above the flagstones. A similar block (**128**) lay to the east (Fig 10).
- 5.2.18 The southern edge of the excavated area was marked by a series of three large, square stone cisterns (**129 – 131**). These had been set into the floor adjacent to the southern wall of the Bleach Croft, but protruded to a height of up to 0.40m above the level of the floor (Plate 79). These cisterns are likely to represent three of the four stone steeping cisterns referred to in the Inventory of 1904 (*Section 3.6.6 above*).



Plate 79: Stone cisterns 129 and 130, looking south

5.3 THE DYE HOUSE

- 5.3.1 An area measuring approximately 40 square metres was excavated across the northern part of the Dye House (Room **20**), as shown on the Valuation and Inventory Plan of 1904 (Fig 9). The excavated area also lay within the footprint of the print works depicted on mid-nineteenth-century mapping (Fig 2).
- 5.3.2 A large machine base (**201/202**), aligned east/west, was exposed in the southern part of the excavated area (Fig 11). This was founded on the flagstones forming the working floor of the Dye House (Plate 80). The machine base clearly comprised two construction phases. The earliest fabric (**201**) comprised a stone base composed of two courses of large worked blocks, surviving to a height of 0.38m, encompassing a large central stone slab that incorporated a vertical machine tie. This component of the machine base measured 2.40 x 0.83m. A large stone block abutting the south-western corner of machine bed **201** appeared to be *ex-situ*, although may originally have formed part of the foundation for a small steam engine.
- 5.3.3 The machine base had been extended subsequently to the east. The extension (**202**) was composed of concrete, and measured 2.20 x 2.05m, incorporating a step with a lower section at the southern end. The upper part formed a level surface flush with the stone base **201**, and incorporated two tie-down bolts.
- 5.3.4 Immediately to the north of machine bed **201/202** were the remnants of a flagstone floor (**203**), which undoubtedly represented the working surface in the Dye House (Plate 81). The component flagstones were of a variety of sizes, and had been laid fairly irregularly, particularly in the northern part of the excavated area (Fig 11).
- 5.3.5 A c 1.9m wide area adjacent to the north side of the machine bed was devoid of flagstones, and is likely to represent the position of a tank or machine (Fig 11). Two large stone blocks (**207**) on the northern side were set 0.08m lower than the surrounding floor. The western block incorporated a 0.08m diameter hole, which may have housed a tie-down rod for a machine. Immediately adjacent to the northern side of the eastern block, and cut through the flagstone floor, were the remains of a vertical iron pipe. This had an internal diameter of 0.08m, and may have furnished a supply of water to a small steam engine.
- 5.3.6 One flagstone (**204**) incorporated a carved, oval-shaped recess, which probably represented a drain cut into the floor. This had seemingly been replaced subsequently with a ceramic drain cover (**205**).



Plate 80: The exposed remains of machine base 201/202



Plate 81: The exposed remains of flagstone floor 203

- 5.3.7 Immediately to the north of drain **205** was a small, rectangular area of granite setts (**206**), measuring 0.90 x 0.65m (Fig 11). The intended function of setts **206** remains uncertain, although they may have provided a foundation for a vertical column.
- 5.3.8 A second machine base (**208**), aligned broadly north-east/south-west, was exposed to the west, beyond the limit of the excavated area, but exposed during initial clearance of the vegetation. This comprised a single stone slab, measuring 2.68 x 0.78m, and was at least 0.44m deep. A narrow slot incised into the surface of the stone block at its eastern end may have been for the flywheel of a small steam engine, although no tie-down bolts survived in the surface of the block.
- 5.3.9 Situated some 7m to the north-east of the machine base **208** was a stone-built tank (**209**). Whilst this lay beyond the edge of the excavated area, and was only exposed during vegetation clearance, this appeared to have been set into the floor of the print shop. It measured 1.58 x 0.98m, and was aligned broadly north-west/south-east.
- 5.3.10 A single layer of bricks had been laid carefully on top off the print shop floor across the northern part of the excavation area. The reason for this is unknown, although it may have been associated with the disuse of the buildings. The bricks and the flagstone floor were sealed beneath a c 0.20m thick layer of topsoil that contained demolition rubble (**200**).

5.4 THE FINDS

- 5.4.1 **Introduction:** a range of artefacts was recovered from the excavation, including fragments of pottery, glass, ceramic building materials and iron objects. In addition, an assemblage of chance finds discovered on the site by members of the local community has been donated for inclusion with the present project archive. All of the material was recovered from demolition or post-demolition deposits, and is thus essentially unstratified. Nevertheless, the finds have provided an interesting dimension to the dataset generated from the archaeological investigation.
- 5.4.2 **Pottery:** numerically, the finds assemblage from the archaeological investigation was dominated by fragments of pottery, which totalled 128 sherds. The majority of this material was recovered during clearance works within the footprint of the Bleach Croft. The bulk of the pottery dates to the period spanning c 1820 to the early 1900s, reflecting the use of the site as a print works, although there are occasional examples of earlier fabrics. The majority of the pottery was either Blackwares, representing utilitarian or kitchenwares, and refined white earthenwares (Barker 2008). Other fabrics present within the assemblage included 20 fragments of industrial slipware, a range of brightly coloured hollow wares, mostly cup forms, common from the 1780s, but here perhaps dating from the 1820s onwards (Barker 1993).
- 5.4.3 The fragments of Blackware vessels recovered from the site are largely typical of the early part of the nineteenth century, representing a limited range of utilitarian vessel types that include rims of pancheons, or large bowls, and

vertical-sided storage jars. Pancheons were usually intended for a variety of uses from washing to food preparation, with different uses being seen by the addition of handle. The other principal Blackware type represented was large cylindrical jars with lug handles, with diameters similar to pancheons (ranging up to 540mm). These storage jars were known commonly as bread pots, and were typical of the North West (Brears 1971, 64-5). Both types of vessel display differing firing methods. The pancheons were either fired upright, as were the cylindrical jars, in stacks separated by ring props, these were made from fire-clay, had an L-shaped cross-section, and curved round to fit against the circumference of the vessels which they were intended to hold apart in the kiln (*op cit*, 134). The other firing method evident in the Tottington assemblage was stacking the vessels rim downwards for firing, which often left characteristic glaze runs on the rims.

- 5.4.4 Blackware is almost ubiquitous on post-medieval sites in the North West, as seen from urban and other assemblages such as, Wigan and Liverpool (OA North 2008; Philpott 1985). The origins of this fabric type can be traced back to the seventeenth century, or earlier, when it was being produced in places such as Prescott on Merseyside, which manufactured a variety of both tableware and more utilitarian vessels. As the eighteenth century progressed there was a reduction in the number of forms produced, as tablewares were produced increasingly in the newer finer stonewares and mottled ware (OA North, 2011). The predominant forms were those described above. The demise of this type of pottery appears to have coincided with the spread of cheaply available whitewares from the late eighteenth century onwards (Brears 1971, 78).
- 5.4.5 Refined white earthenwares are by far the commonest type of pottery from the nineteenth century and, unsurprisingly, constitute the largest number of sherds within the pottery assemblage. This fabric type is typified by blue and white transfer-printed vessels such as plates, saucers and cups. Some earlier examples do occur, such as creamware, which was produced in large quantities in the north of England by the 1780s (Draper 1984, 47), although declining in popularity, it was still present in the 1820s (Barker 2008).
- 5.4.6 Approximately half of the fragments of refined white earthenwares are plain, whilst others exhibit the most common transfer-printed design, Chinese willow pattern, which continued in use throughout the nineteenth century and beyond, and are therefore not particularly datable. Three fragments of plate rim from the assemblage have a moulded edge, with a blue glaze. One fragment can be dated to the period c 1780-1830, whilst the others are somewhat later, being common in the 1840s-60s.
- 5.4.7 The pottery assemblage also contained fragments of industrial slipware. This type of fine earthenware, with elaborate slip decoration, was produced from the 1780s onwards (Barker 1993, 27). The examples from the Tottington are nearly all mug or cup forms, with the exception of a few sherds which may be part of a jug. Generally, the decoration is annular, or horizontal banding, in blues and blacks. Some of the vessels exhibit evidence of engine-turned ribbing and polka-dots. A single example, possibly a jug form, exhibits marbling, a common form of decoration, popular until well into the nineteenth

century (*ibid*). However, the vessels recovered from the site probably date to the period c 1830-50.

- 5.4.8 Other wares include a complete stoneware ink bottle, manufactured by Gibbs and Canning Ltd of Tamworth, a company perhaps better known for the ceramic mouldings found such as noted buildings as the Royal Albert Hall (Sheppard 1975). Several sherds of Nottinghamshire/Derbyshire-type stoneware and two fragments of Black Basaltes, a hard black stoneware produced from the middle of the eighteenth century (Draper 1984, 43) and still common in the early nineteenth century, but remained in limited production through the twentieth century (Hume 1970).
- 5.4.9 In conclusion, the pottery recovered from Tottington Print Works could be described as a 'typical' domestic assemblage of the nineteenth century, comprising as it does both utilitarian kitchen wares and higher quality table ware. What is unusual about the assemblage is that it was derived entirely from an industrial setting, only the ink bottle being attributable to the work carried out at the print works. The assemblage might reflect a hitherto unrecorded element of factory life that has so far been overlooked archaeologically, with emphasis being placed on structural components, rather than the daily life of the employees. As such, this assemblage may contribute toward an important, but little investigated side of factory life, since there appears to have been very little research into the use of ceramics within a factory setting.
- 5.4.10 **Other ceramics:** numerous fragments of ceramic 'pot-eyes' were also recovered from the site. These will have derived from machines and wall fittings, and were intended to guide the rope of cloth between the various processing stages in the bleach croft.
- 5.4.11 **Glass:** a small assemblage of glass fragments was recovered from the excavation. For the most part, the assemblage comprised fragments of glass vessels, although sherds of window glass were also present.
- 5.4.12 **Metal object:** a variety of metal objects were recovered from the site, many of which represented fragments of machine fittings and tools. Perhaps the most interesting objects are six metal tallies discovered by chance by Mr RJ Binns. These were found on the bank of the Kirklees Brook by the twentieth-century filter beds at the southern end of the site. Four of the tallies are of copper alloy, and the remaining two are of aluminium, but all bear the text 'S Knowles & Co Tottington Mill' (Plates 82 and 83). These were used by the mill workers as a means of 'clocking-in' to work.



Plate 82: A metal tally discovered between the filter beds and the Kirklees Brook by Mr RJ Binns



Plate 83: A metal tally discovered between the filter beds and the Kirklees Brook by Mr RJ Binns

6. COMMUNITY ENGAGEMENT

6.1 INTRODUCTION

- 6.1.1 The archaeological investigation at Tottington Print Works elicited considerable interest and support from the local community. In total, 12 days of clearance and excavation work were carried out on site by volunteers, under the supervision and guidance of OA North staff. In the first instance, a group from the British Trust for Conservation Volunteers (BTCV) carried out the clearance of scrub vegetation, permitting the survey of upstanding elements of the former print works, and enabling two areas of the site to be targeted for limited excavation. Much of the excavation work was carried out by volunteers with the Bury Rangers, who provided four days of input.
- 6.1.2 The excavation work was coupled with several public open-day events. The first of these was concerned primarily with explaining the project and the history of the site to visitors, coupled with tours of the exposed remains. The second and third events were billed as 'practical days', where members of the public were invited to help with the excavation work. A considerable number of the local community participated, with an age range spanning 4 years old to c 74.
- 6.1.3 The fieldwork culminated with a public lecture that was delivered at Greenmount Church. This well-attended event presented the results obtained from the documentary research and the excavation work.



Plate 84: Visitors at a public open day on site



Plate 85: Volunteers with the Bury Rangers excavated the remains of the Bleach Croft in July 2011



Plate 86: Volunteers with the Bury Rangers excavated the remains of the Print Shop in August 2011



Plate 87: Volunteers cleaning the excavated remains at the public open day in July 2011



Plate 88: Volunteers cleaning the excavated remains at the public open day in July 2011



Plate 89: Volunteers at the third public open day in September 2011



Plate 90: Young volunteers excavating one of the stone tanks in the Bleach Croft in September 2011

7. ENVIRONMENT AGENCY WORKS

7.1 TEST PITS

- 7.1.1 In February 2011, the Environment Agency excavated five small test pits along the route of the culvert (Plate 89). The work was carried out to establish the level of contamination in the ground, and thus inform the Environment Agency's proposal to remove the culvert. All of the test pits were excavated manually. However, in all cases, demolition rubble was encountered immediately beneath the topsoil, resulting in the abandonment of the excavation. Similar material encountered in the excavation of the Dye House (Section 5.3 above) was seen to overlie *in-situ* structural remains of archaeological interest.



Plate 91: Location of the test pits excavated by the Environment Agency

8. ASSESSMENT OF SIGNIFICANCE

8.1 STATEMENT OF SIGNIFICANCE

- 8.1.1 **Summary statement:** the structural remains of Tottington Print Works, including the culvert for the Kirklees Brook, are considered to be of Great Significance, with high evidential, historical, and aesthetic values. The site provides a rare surviving example of a calico-printing works, comprising the extensive remains of an industry that was crucial to the economic development of the area during the nineteenth century. The visible remains also make an important contribution to the historic character and appearance on the Kirklees Valley Local Nature Reserve.
- 8.1.2 **Evidential value:** the main evidential value lies in the historic fabric of the surviving remains. Extensive structural remains of the site are visible, representing the progressive development of the site from the mid-nineteenth century to the late 1920s. Indeed, despite having been demolished in the early 1930s, the surviving remains represent one of the best examples of a calico-printing works in north-west England. The remains also represent the industrial development of the Kirklees Valley
- 8.1.3 The physical remains are coupled with a considerable body of surviving historical documentation for the development of the print works. In particular, the Valuation and Inventories compiled by the Calico Printers' Association provide a comprehensive and detailed account of the component buildings and the machinery that they housed in the early twentieth century.
- 8.1.4 **Historical value:** the standing remains have an historical illustrative value in demonstrating the extent and layout of a nineteenth- and twentieth-century calico-printing works. The structural remains also have a high historical value in representing a key period in the development of the Kirklees Valley as a centre of the textile-finishing industries during the nineteenth century.
- 8.1.5 The site also has an historical value in terms of its documented association with a medieval corn mill, and a late eighteenth-century cotton-spinning mill, whilst the print works is associated with several key developments in calico-printing, and appears to have been at the forefront of that branch of the textile industry by the late nineteenth century. In 1883, for instance, it was reported that one of the largest printing machines ever made had recently been installed at the works (*Section 3.5.25 above*), whilst Samuel Knowles had been accredited previously with introducing to the industry a ground-breaking system of oxidising and precipitating colours by means of chlorate of potash (*Section 3.5.3 above*).
- 8.1.6 **Aesthetic value:** elements of the print works complex are distinctive local landmarks. In particular, Tower Farm and the series of lodges are inextricably linked to the development of the print works, and yet their historic meaning is somewhat lost outside the context of the print works.

- 8.1.7 **Communal value:** the building has some communal value, not least embodied in its association with the Knowles family, whose name is inextricably linked to the development of the local textile industry, and the establishment of Greenmount; Samuel Knowles was one of the three founders of Greenmount Sunday School in 1848, which led to the identification of Greenmount as a village separate to Tottington. Samuel Knowles also laid the corner stone of Greenmount Independent Church in April 1865 and, in 1876, was instrumental in promoting the Bury and Tottington and District Railway, in order to provide the print works with an efficient transport link. This necessitated the construction of the viaduct across Island Lodge, a notable local landmark.
- 8.1.8 In determining the value of the site of Tottington Mill as a heritage asset, the Secretary of State's criteria for assessing the national importance of monuments has also been considered (Department of Culture, Media, and Sport 2010). These criteria relate to period, rarity, documentation, group value, survival/condition, fragility/vulnerability, diversity, and potential.
- 8.1.9 **Period:** the site of Tottington Mill dates to the medieval period, with significant development during the post-medieval and industrial periods. The above-ground remains, including the lodges, date largely to the nineteenth and early twentieth centuries, although further detailed archaeological survey of the extant remains may conclude that elements of the surviving fabric can be attributed to the late eighteenth-century cotton mill. It is certainly possible that elements of the cotton mill, and the earlier corn mill, may survive as buried remains. In particular, it seems possible that a waterwheel pit associated with these documented buildings may survive beneath nineteenth-century floors.
- 8.1.10 **Rarity:** in contrast to the prevalence of textile-finishing works that were active in the area during the nineteenth and early twentieth centuries, surprisingly few survive in the modern landscape. It is of note that as early as 1913, Tottington was one of only 16 operating print works in the whole of Lancashire that had been established prior to 1846 (*Section 3.5.31 above*). The extent of the surviving remains of Tottington Print Works, which represent the development of the mill from the mid-nineteenth century through to the late 1920s are extremely rare. This reflects the lack of any development on the site following the demolition of the print works. Indeed, the remains probably represent the most extensive above-ground remains of a textile print works in the county.
- 8.1.11 **Documentation:** there is very little primary documentation for the development and use of the medieval and post-medieval corn mills, and the late eighteenth-century cotton mill. The paucity of documentation increases the importance of any physical remains that may survive. Conversely, there is a considerable body of evidence for the development and use of the print works, particularly for the period spanning the late nineteenth and early twentieth centuries. The combination of surviving physical remains with the wealth of documentary material provides a unique opportunity to understand fully the layout and infrastructure of a nineteenth-century print works.

8.1.12 **Group value:** the remains of Tottington Print Works have a high group value with the sites of other industrial sites, including textile-finishing works, in the Kirklees Valley. The Ordnance Survey map of 1848 marks nine textile-manufacturing sites along the Kirklees Brook, with an additional four sites in the immediate vicinity (Plate 90). Few of these sites survive, although some of the historical structures (including the chimney) remain on the site of Stormer Hill Bleach Works, which have a group value with Tottington Print Works. Tottington Print Works also has a group value with the series of lodges in the Kirklees Valley, and with Tower Farm. In addition, group value is provided by the former railway, represented vividly by the Island Lodge Viaduct.

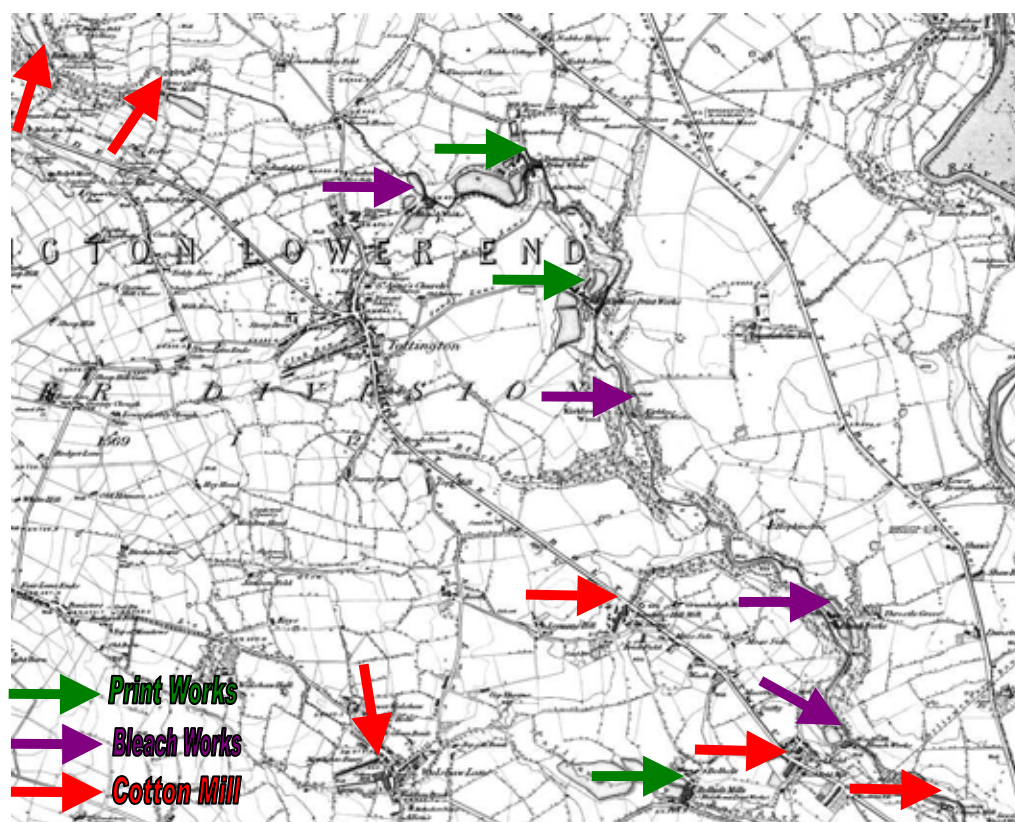


Plate 92: Location of the textile-manufacturing sites in the Kirklees Valley and vicinity shown on the Ordnance Survey map of 1848

8.1.13 **Survival/Condition:** despite having been largely demolished in the 1930s, considerable remains of the print works survive as structural features of the local landscape. The limited archaeological excavation carried out as part of the present project, moreover, has demonstrated that extensive and well-preserved remains of the print works survive *in-situ* as buried remains.

8.1.14 **Fragility/Vulnerability:** the extant remains are not particularly fragile, although the stone-built walls lining the channel of the Kirklees Brook through the eastern part of the site are in a poor structural condition, and vulnerable to collapse. The issue of addressing the collapse of masonry structures will need to be considered in any future strategies for the long-term management of the site.

- 8.1.15 **Potential:** the site has considerable potential to contain important buried remains of the print works, and potentially also of the medieval corn mill and the late eighteenth-century cotton mill. The site also has considerable potential for further investigation, research and interpretation, elements of which could be carried out as a community-based project, and usefully enhance the present understanding of the site.
- 8.1.16 One strand of further investigation could focus on the mechanism of the water-management systems. The precise chronology and rationale for the construction of the various weirs across the Kirklees Brook, for instance, has not been fully established. Of particular interest would be an elucidation of the means by which the waterwheels associated with the medieval corn mill and the eighteenth-century cotton mill were powered. One possibility is that one of these buildings was converted subsequently for use as the White Room (Room 22), and had been powered originally by an overshot or high breast shot waterwheel fed via a launder from Island Lodge.
- 8.1.17 Notwithstanding the wealth of documentary evidence that has been collated as part of the present project, there is potential for further desk-based research. Whilst previous studies of the calico-printing industry have furnished sufficient data to allow the size and scale of Tottington Print Works in the mid-nineteenth century to be compared with other contemporary works (eg *Appendix 3*), further research of the Calico Printers' Association archive could enable a comparison of the site with other print works operating in the early twentieth century.
- 8.1.18 The extant and excavated remains of the print works provide opportunities for the interpretation and presentation of the site to the wider public. Most easily, purpose-built information boards could be placed within or adjacent to the exposed remains, allowing the visitor to see both the results of the excavation, and an explanation of the visible fabric. A larger-scale presentation of the monument could include further excavation and consolidation of salient features, most notably the engine houses and stone cisterns, as has been achieved to some degree at The Burrs in Bury and at Hodge Print Works in Tameside. With appropriate associated signage, this would prove an invaluable educational resource for the area, presenting rare yet tangible physical remains of this important local industry.

9. IMPACT OF THE ENVIRONMENT AGENCY SCHEME

9.1 INTRODUCTION

- 9.1.1 The project was initiated from a proposal by the Environment Agency to remove the culvert that channels the Kirklees Brook through the centre of the print works site. The culvert was constructed in several phases, being extended in consequence of the expansion of the print works during the second half of the nineteenth and early twentieth centuries.
- 9.1.2 Current planning policy guidance for the historic environment, embodied in PPS 5, advises that archaeological remains are a continually diminishing resource and should be seen as finite, and non-renewable resource, in many cases, highly fragile and vulnerable to destruction. Appropriate management is therefore essential to ensure that they survive in good condition, although recognising that change is inevitable. Thus, whilst it is considered right to provide protection and support for our past, this must be managed intelligently, with an appropriate balance of priorities and an understanding of what could be gained or lost. It has been the intention of this study to identify the sub-surface archaeological potential of the study area, and assess the impact of the proposed removal of the culvert, thereby allowing the advice of the PPS 5 to be enacted upon.

9.2 LEGISLATIVE FRAMEWORK

- 9.2.1 ***Planning Background and Legislative Framework:*** in considering any planning application for development, local planning authorities are bound by the policy framework set by government guidance. This guidance provides a material consideration that must be taken into account in development management decisions, where relevant. In accordance with central and local government policy, this desk-based assessment has been prepared in order to clarify the study site's archaeological potential, and to assess the need for any further measures to mitigate the impact of the proposed development.
- 9.2.2 National planning policies on the conservation of the historic environment are set out in Planning Policy Statement PPS 5 *Planning for the Historic Environment*, which was published by the Department for Communities and Local Government (DCLG) in March 2010. The policies set out in PPS 5 also apply to the consideration of the historic environment in relation to other heritage-related consent regimes for which planning authorities are responsible under the Planning (Listed Buildings and Conservation Areas) Act 1990. Annex 2 of PPS 5 defines as a heritage asset 'a building, monument, site, place, area or landscape positively identified as having a degree of significance meriting consideration in planning decisions'; heritage assets are also defined as 'valued components of the historic environment'.

9.2.3 In summary, PPS 5 provides a framework that:

- requires applicants to provide proportionate information on heritage assets affected by the proposals, and an assessment of the impact of the proposed development on the significance of the heritage asset;
- has a presumption in favour of the conservation of designated Heritage Assets, which include World Heritage Sites, Scheduled Monuments, Listed Buildings, Protected Wreck Sites, Registered Parks and Gardens, Registered Battlefields or Conservation Areas;
- protects the settings of such designated heritage assets;
- takes into account the desirability of sustaining and enhancing the significance of heritage assets;
- where the loss of whole or part of a heritage asset's significance is justified, provides for the recording of assets, and for publication of the resulting evidence.

9.2.4 With reference to specific policies, PPS 5 Policy HE6.1 states that local planning authorities 'should require an applicant to provide a description of the significance of the heritage assets affected and the contribution of their setting to that significance'. Policy HE6.1 also recommends that 'where an application site includes, or is considered to have the potential to include, heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where desk-based research is insufficient to properly assess the interest, a field evaluation'.

9.2.5 **Regional Policy Framework:** the approved Regional Spatial Strategy (RSS) for the North West (The North West Plan) was adopted in September 2008. The RSS replaces the Regional Planning Guidance 13 for the North West (RPG 13), together with the relevant County Structure Plans. Policy EM1 (C) embedded within the RSS contains policies relating to the historic environment, and specifies that plans, strategies, proposals and schemes should protect, conserve and enhance the historic environment supporting conservation-led regeneration in areas rich in historic interest.

9.3 ASSESSMENT METHODOLOGY

9.3.1 The results of the assessment have identified the significance of the archaeological resource of the Application Area. In order to assess the potential impact of future development, consideration has been afforded to:

- assessing in detail any impact and the significance of the effects arising from any future development of the Application Area;
- reviewing the evidence for past impacts that may have affected the archaeological sites of interest identified during the desk-based assessment;
- outlining suitable mitigation measures, where possible at this stage, to avoid, reduce, or remedy adverse impacts.

- 8.3.1 Key impacts have been identified as those that would potentially lead to a change to the archaeological site. Each potential impact has been determined as the predicted deviation from the baseline conditions, in accordance with current knowledge of the site and the proposed development.
- 8.3.2 Table 4 shows the sensitivity of the site scaled in accordance with its relative importance using the following terms for the archaeological issues, with guideline recommendations for a mitigation strategy.

Importance	Examples of Site Type	Mitigation
National	Scheduled Monuments (SMs), Grade I and II* Listed Buildings	To be avoided
Regional/County	Conservation Areas, Registered Parks and Gardens (Statutory Designated Sites), Grade II Listed Buildings	Avoidance recommended
Local/Borough	Sites with a local or borough archaeological value or interest Sites that are so badly damaged that too little remains to justify inclusion into a higher grade	Avoidance not envisaged
Low Local	Sites with a low local archaeological value Sites that are so badly damaged that too little remains to justify inclusion into a higher grade	Avoidance not envisaged
Negligible	Sites or features with no significant archaeological value or interest	Avoidance unnecessary

Table 4: Criteria used to determine Importance of Sites

- 8.3.3 The impact is assessed in terms of the sensitivity or importance of the site to the magnitude of change or potential scale of impact during the proposed development. The magnitude, or scale of an impact is often difficult to define, but will be termed as substantial, moderate, slight, or negligible (Table 5).

Scale of Impact	Description
Substantial	Significant change in environmental factors; Complete destruction of the site or feature; Change to the site or feature resulting in a fundamental change in ability to understand and appreciate the resource and its cultural heritage or archaeological value/historical context and setting.
Moderate	Significant change in environmental factors; Change to the site or feature resulting in an appreciable change in ability to understand and appreciate the resource and its cultural heritage or archaeological value/historical context and setting.
Slight	Change to the site or feature resulting in a small change in our ability to understand and appreciate the resource and its cultural heritage or archaeological value/historical context and setting.
Negligible	Negligible change or no material changes to the site or feature. No real change in our ability to understand and appreciate the resource and its cultural heritage or archaeological value/historical context and setting.

Table 5: Criteria used to determine Scale of Impact

- 8.3.4 The interaction of the scale of impact (Table 5) and the importance of the archaeological site (Table 4) produce the impact significance. This may be calculated by using the matrix shown in Table 6:

Resource Value (Importance)	Scale of Impact Upon Archaeological Site			
	Substantial	Moderate	Slight	Negligible
National	Major	Major	Intermediate/ Minor	Neutral
Regional/County	Major	Major/ Intermediate	Minor	Neutral
Local/Borough	Intermediate	Intermediate	Minor	Neutral
Local (low)	Intermediate / Minor	Minor	Minor/ Neutral	Neutral
Negligible	Neutral	Neutral	Neutral	Neutral

Table 6: Impact Significance Matrix

- 8.3.5 The impact significance category for the archaeological site of interest will also be qualified, and recommended mitigation measures will be provided, where possible at this stage, to impacts that are of moderate significance or above. It is also normal practice to state that impacts above moderate significance are regarded as significant impacts. It is important that the residual impact assessment takes into consideration the ability of the mitigation to reduce the impact, and its likely success.
- 8.3.6 It is also considered important to attribute a level of confidence by which the predicted impact has been assessed. For the purpose of this assessment, the criteria for these definitions are set out in Table 7 below.

Confidence in Predictions	
Confidence Level	Description
High/Certain	The predicted impact is either certain, <i>ie</i> a direct impact, or believed to be very likely to occur, based on reliable information or previous experience, and may be estimated at 95% chance or higher.
Medium/Probable	The probability can be estimated to be above 50%, but below 95%.
Low/Unlikely	The predicted impact and its levels are best estimates, generally derived from the experience of the assessor. More information may be needed to improve the level of confidence, which can be estimated using the present information at above 5% but less than 50%.
Extremely Unlikely	The probability can be estimated at less than 5%.

Table 7: Impact Prediction Confidence

9.4 IMPACT

- 9.4.1 By the mid-nineteenth century, the culvert was only 12m long, extending beneath the floor of one of the principal buildings (Fig 2). This building had been expanded as the Dye House by the early 1890s, a development that necessitated an extension of the culvert to a length of approximately 102m (Fig 3). The south-eastern end of the culvert was extended subsequently by a further 32m, to create its maximum length of approximately 134m by the early twentieth century. However, sections of the culvert were removed during the demolition of the print works in the early 1930s, reducing its length to c 43.8m. The surviving section of the culvert incorporates those elements that were constructed during the nineteenth century, and are sealed beneath the floor of the Dye House.
- 9.4.2 The assessment of the site (*Section 8 above*) has concluded that the site of Tottington Print Works is of *Regional/County* importance, as the remains represent the rare, and possibly unique, survival of a calico-printing works. The removal of the surviving section of the culvert through the centre of the site will have a *Substantial Impact*, as it will result in the complete destruction of the feature, and a potential significant change in environmental factors. In addition, the removal of the culvert will necessitate the removal and destruction of historical flooring and other structural remains within the Dye House, thereby having a *Substantial Impact* on the wider site. The scale of impact may be thus considered as *Major*.
- 9.4.3 The limited programme of archaeological excavation carried out within the footprint of the Dye House has demonstrated conclusively that extensive buried remains of archaeological interest survive *in-situ*. The Confidence Level in determining that the scale of impact will be Major is thus *High/Certain*.

9.5 MITIGATION

- 9.5.1 The implementation of the Environment Agency's proposal to remove the culvert that runs through the centre of the former print works would clearly have substantial impact on the heritage of the site. In order to mitigate this negative impact, it is envisaged that a robust programme of archaeological works would be necessitated prior to, and during, the removal of the culvert.
- 9.5.2 Whilst the precise scope and extent of any such mitigation would be devised by Bury Council, in close consultation with the Greater Manchester County Archaeologist, it may be anticipated that the route of the culvert will need to be excavated archaeologically prior to removal. This would enable a detailed record to be compiled of the surfaces and surviving historic fixtures and fittings within those parts of the Dye House that overlie the culvert. It should be stressed that the method statement for the Environment Agency's works should be devised carefully to ensure that, wherever possible, there is no requirement for any earth-moving works beyond the line of the culvert, as this may have an unacceptable impact on the buried remains of the former print works.

- 9.5.3 In addition, once the overlying structures had been recorded fully, the removal of the culvert is likely to require archaeological monitoring to enable the fabric of the culvert to be examined. In particular, the side walls of the culvert may retain important evidence for earlier structures, potentially associated with the documented corn mill and eighteenth-century cotton mill and their water-management systems. Once the capping of the culvert has been removed consideration will also need to be afforded to the consolidation of the side walls, which act as retaining structures for the floor surfacing in the Dye House, to ensure that there was no subsequent loss of historic structures through erosion or slumping.

10. CONCLUSION

10.1 CONCLUSION

- 10.1.1 The archaeological investigation has demonstrated that the site of Tottington Print Works is a heritage asset of considerable importance. Extensive and well-preserved structural elements of the print works survive extant, and there is significant potential for further elements to remain *in-situ* beneath scrub vegetation and demolition rubble, offering considerable opportunities for further research, investigation and, perhaps most importantly, interpretation. In addition, the wealth of documentary evidence for the development and use of the print works, particularly for the period spanning the late nineteenth and early twentieth centuries, adds weight to the importance of the site. The combination of this large body of documentary material with the extensive surviving physical remains provides a unique opportunity to understand fully the layout and infrastructure of a late nineteenth-century print works.
- 10.1.2 Further investigation of the site could inform some of the initiatives for archaeological research of the industrial and modern periods stated in the current *Archaeological Research Framework for North West England* (Brennand 2007). In particular, ‘industry specific studies are needed for those industries that have received little archaeological attention’ (Newman and McNeil 2007, 154). Whilst the physical remains of the region’s textile industry has received a considerable amount of archaeological investigation and research since the late twentieth century (*eg* Williams with Farnie 1992; Giles and Goodall 1992; OA North 2010), this has tended to focus on those sites intended for cotton spinning and weaving, as these dominated the industry. However, the textile-finishing branches of the industry, including bleaching, dyeing and printing, were of fundamental importance to the nineteenth-century economic and social development of numerous parts of the historic county of Lancashire, with the Irwell Basin emerging as a leading centre for the trade. Very few, if any, nineteenth-century calico-printing works survive intact in Greater Manchester or Lancashire, most having been converted beyond recognition for other uses or demolished and their site redeveloped (OA North 2010). In this respect alone, Tottington Mill is of considerable archaeological interest as it incorporates rare physical evidence for the progressive development of a calico-printing works from the mid-nineteenth century through to the late 1920s, and has considerable potential to be heralded a ‘type site’ for this former industry.
- 10.1.3 A nomination of Tottington as ‘type site’ for the calico-printing industry is perhaps supported by the data furnished from the list of English calico printers of 1840 (*Appendix 3*). Based on the number of printing machines and hand-block printing tables housed in Tottington Print Works at that date, the works can be seen to have been a medium-sized operation; the list of 1840 records five printing machines and 95 tables at Tottington, whilst the average numbers from the 94 sites for which details are provided are four and a half machines and 85 printing tables. Similarly, taking those sites listed that lie within the

boundary of the modern borough of Bury, for which there are details of 14 print works (*Appendix 3*), the average works housed five printing machines and 96 tables. Using these figures, Tottington can be considered as an exemplar of a mid-nineteenth-century print works in the Bury area. Further research, focused particularly on the records held within the Calico Printers' Association archive, could elucidate a better understanding of the relative size and importance of Tottington in the context of early twentieth-century print works.

- 10.1.4 The proposed removal of the culvert that channels the Kirklees Brook through the centre of the site will have a substantial negative impact upon the heritage asset. If implemented, this proposal would require a robust programme of archaeological works to mitigate the impact. As a minimum, this should include the detailed excavation and recording of any buried remains of the print works that would be damaged or disturbed as part of the proposed works. This should be coupled with a consideration of how the side walls of the culvert should be consolidated to ensure that there is no subsequent erosion of historic remains on either side of the culvert.
- 10.1.5 The present project has also demonstrated conclusively that there is a high-level of interest locally in the site, highlighting the considerable potential for further archaeological investigation of the site. Elements of this could be achieved most usefully by involving the local community, which could culminate in the appropriate consolidation and interpretation of the exposed remains. It is suggested that the site demonstrably merits consideration for the award of a substantial funding package from a body such as the Heritage Lottery Fund to enable the worthy heritage aspirations of the site to be achieved.
- 10.1.6 In line with the guidance provided by PPS 5, it is considered appropriate that the results obtained from the archaeological works carried out to date should be published in an appropriate manner. This could be achieved most effectively via presentation in an illustrated booklet on the textile-printing industry of the Irwell Basin, and published as part of the *Greater Manchester's Past Revealed* series. This would enable the results obtained from the archaeological works to be disseminated to a wide audience, and help to celebrate the rich industrial heritage of the Kirklees Valley and the wider area.

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APPENDIX 1: PROJECT BRIEF

BRIEF FOR ARCHAEOLOGICAL SURVEY AT THE SITE OF TOTTINGTON MILL PRINT WORKS, KIRKLEES VALLEY, TOTTINGTON, BURY

Background

The Environment Agency are proposing to remove a culvert in the Kirklees Valley which is impeding the flow of water during high rainfall. The culvert once formed part of the extensive complex of industrial buildings known as Tottington Mill Print Works. The Environment Agency are therefore funding phase 1 investigations along the line of the culvert to ascertain whether there are any contaminated land or archaeological constraints to this proposal. Bury Council, the landowners, are also interested to learn more about the extensive visible remains of the Print Works. These take the form of stone dye/bleach tanks, engine beds, fireproof bricks and fuel waste from boiler house/s, iron restraining rods, sluice mechanisms, retaining walls, and wall foundations, set in a scrub and woodland environment beside Kirklees Brook. Several of the reservoirs and associated filter beds survive in the wider landscape. Bury Council would like to provide additional funds to extend the archaeological investigations over the entire footprint of Tottington Mill Print Works.

The mill site is located at SD 7805 1367 and entered on the Greater Manchester Historic Environment Record as No.8724.



Culvert arch and bridge on east side of former works.

Western end of culvert

This site probably originated as a manorial mill mentioned in 1296. The site is shown on Yates' map, surveyed in c.1775-80. The manorial corn mill was leased to John Leigh in 1790, who began a cotton spinning mill with Arkwright dimensions. Described as a new corn mill with kiln recently erected in 1792. Joshua Knowles acquired the site in 1821 and built it up into a large print works and bleach works. The site is shown on the north side of the brook on the OS 1st Edition OS " map c1848 with a long arm extending over the brook where the culvert is now. This may indicate where the original corn mill and water wheel was located. Subsequently the site expanded considerably as can be seen on the 1908 OS 25" map. The works closed in 1927 and the buildings were soon demolished, although the engraving workshop continued in use until 1940.

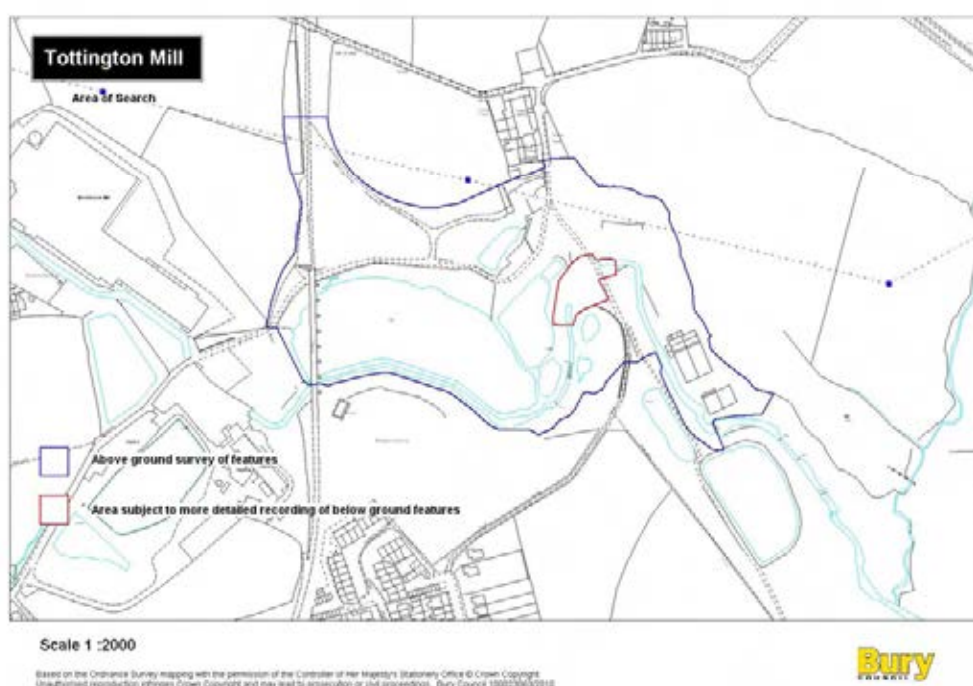
research, and a measured survey of extant remains, leading to an interpretation of the phasing, function and significance of the archaeological remains. Further investigation, in the form of evaluation trenching to determine the below-ground significance of the archaeology and excavation and survey ahead of and during the EA operations affected area, is likely to follow. Local groups have a considerable interest in the history and archaeology of the site and community engagement will form part of the exercise.

It is apparent that between 0.5 to 1m depth of overburden covers the arched stone roof of the culvert over the stream. It is anticipated that archaeological deposits will survive quite well here and could relate to floor surfaces and machine beds and processing. These remains would be removed and will require archaeological recording prior to disturbance. Furthermore, it is likely that in removing the culvert previously hidden archaeological features will be exposed which will also need to be recorded and understood. The exposed revetting walls flanking the stream may require consolidation. This may provide an opportunity to conserve and present archaeological features. The EA are undertaking contaminated land investigations which will provide useful information on below-ground archaeology levels and potential. This data will be incorporated into the archaeological survey report.

Many corn mills across Greater Manchester were re-used as textile sites in the industrial period, from the 18th century onwards, initially as fulling or scribbling mills but later on many were expanded and adapted as textile finishing works. The key elements of textile finishing works include:

- multi-storey warehouses for storing the large amount of cloth
- a range of machines, tanks and kiers for processing, which were housed initially in separate sheds but later became unified under one roof
- a plentiful supply of clean water for washing and cleaning the cloth throughout the bleaching/printing process
- the power systems needed to run each mechanical process, initially water powered but from the 1790s increasingly steam powered.

Brief



The study area includes all the land within the blue line. The red lined area will be affected by the Environment Agency scheme. The most significant archaeological remains appear to be across the areas shown on the OS 1848 map footprint. The archaeological survey will take the following form:

1. Archaeological Desk Based Assessment/Historical Research

- i) Undertake a historic map regression exercise to produce scaled-up maps showing the site's evolution and identifying the location of any former buildings and buried features. A colour coded map will be produced at an appropriately large scale showing the phasing of former buildings and other features in relation to the modern site plan.
- ii) Analyse information supplied through the watching brief carried out for EA's contaminated land investigation. This will be a priority piece of work to inform if further investigations are required to understand the archaeology and allow an appropriate scheme of mitigation to be devised. This will include the desk based assessment within the red line area.
- iii) Analysis of readily accessible historical documentation will be undertaken to inform interpretation and our understanding of the origin and function of former buildings across the sites. It will be important to describe the historical context of the study area, proving an understanding of the way the surrounding landscape and settlement patterns changed through time. Sources of information to be examined include: Bury Archives, Lancashire Record Office, Greater Manchester Record Office, records and knowledge held by local historians (including Luke Lavan) and societies, the Greater Manchester Historic Environment Record*, Bury MBC records.
- iv) There should be a gazetteer linked to a plan listing all features of archaeological interest within the proposal boundaries.
- v) There will be a site inspection of the study site to relate research findings to the existing landscape.
- vi) Comparative research will be undertaken to help interpret the function and relative significance of industrial archaeological features, the likelihood for potential remains and suggest a mitigation strategy, for further, targeted investigation, presentation and interpretation.

2. Archaeological Survey of visible remains:

- Based on the findings of the watching brief carried out during the contaminated land investigation, undertake further trenching and/or test pitting and internal culvert investigations along the line of the culvert as necessary.
- Map and produce measured survey of exposed remains.
- Clear vegetation where it obscures key areas.
- Overlay surveyed remains onto historic and modern mapping.
- Supervise volunteers in clearing vegetation and train them in basics of measured survey, excavation recording and interpretation.
- Give a lecture to local heritage group members on the results of the survey.
- Provide a report presenting results of survey, interpretation and recommendations for further work including investigation and presentation.

3. Report

The report will be split in to two parts, the first relating to the culvert line investigations which will identify any constraints for the EA scheme, the second being the study of the wider site. These reports will be produced to an agreed timetable. The main report for the wider site will include:

- i) A summary statement of the survey's findings.
- ii) The background to the survey including location details.
- iii) An outline of the methodology of the survey.
- iv) A section charting the historic development of the sites and surrounding landscapes, supported by detailed map evidence and old photographs (if available).
- v) A discussion of the likely character of archaeological remains, with comparative assessment based on research into other sites in Greater Manchester and further afield.
- vi) A discussion of the heritage assets identified, including relative significance, setting and potential – using Annex 1 criteria of the Scheduled Monument Consent Guidance issued by DCMS in March 2010.
- vii) A gazetteer showing all features of archaeological interest, linked to a location plan.
- viii) Presentation of a mitigation strategy based on significance, vulnerability, consolidation and presentation, interpretation, publication and educational opportunities.
- x) A catalogue of archive items, including a list of photographs.
- xi) A copy of the brief.

1.1 ARCHIVE AND PUBLICATION

- i) An ordered site archive will be deposited with the Bury Archives within 6 months of completion of the development.
- ii) Copies of reports will be given to the above, the Environment Agency, Bury MBC Planning, relevant local heritage groups/individuals, GMAU.
- iii) The Greater Manchester Historic Environment Record supports the Online Access to Index of Archaeological Investigations (OASIS) project. The overall aim of the OASIS project is to provide an online index to the mass of archaeological grey literature that has been produced as a result of the advent of large-scale developer funded fieldwork. The archaeological contractor must therefore complete the online OASIS form at <http://ads.ahds.ac.uk/project/oasis/> . Contractors are advised to contact the Greater Manchester Historic Environment Record prior to completing the form. Once a report has become a public document by submission to or incorporation into the HER, the Greater Manchester Sites and Monuments Record may place the

information on a web-site. Please ensure that you and your client agree to this procedure in writing as part of the process of submitting the report to the case officer at Greater Manchester Historic Environment Record.

iv) The site will be published to an appropriate level commensurate with the significance of the survey results.

Break down of costs for tenders

- i) The Environment Agency will require an estimate for the culvert investigations as a stand alone element – these include the desk based assessment study element within the red line area.
- ii) Bury Council will require the remainder of the brief to be split as follows as it may not be possible to fund all elements in the first instance:
 - a) Undertake desk based assessment but not the analysis of the EA contaminated land watching brief.
 - b) Map and produce measured survey of exposed remains including vegetation clearance where it obscures key areas.
 - c) Overlay surveyed remains onto historic and modern mapping and produce the report including the recommendations.
 - d) Supervise volunteers in clearing vegetation and train them in basics of measured survey, excavation recording and interpretation.
 - e) Give a lecture to local heritage group members on the results of the survey.

Other Considerations

- 1) The County Archaeologist will be consulted on a draft report and recommendations for mitigation.
- 2) The archaeological contractor will abide by the Institute of Field Archaeologists Bye-Laws of Approved Practice.
- 3) Contractors shall comply with the requirements of all relevant Health & Safety legislation and adopt procedures according to guidance set out in the Health & Safety Manual of the Standing Conference of Archaeological Unit Managers (now known as FAME – Federation of Archaeological Managers and Employers).
- 4) The Environment Agency has a policy that requires the report to be double sided and produced on recycled paper containing at least 80% post consumer waste.

Norman Redhead
County Archaeologist
GMAU – 3/12/10

APPENDIX 2: 1904 VALUATION AND INVENTORY

Plan No	Description	Size	Floors	Structure
1	Gas retort house (stone built), with square brick-built chimney	30 x 17ft	1	Corrugated and slated timber roof and pair of large sliding doors
1a	Store sheds (timber built)	33 x 12ft 30 x 11ft	1	Timber sheds in front of retorts. Flag floor.
2	Printers shop (stone built)	19 x 16ft		Flag floor and slated roof
3	Smithy (stone built), and lean-to store shed Stone-built chimney, c 50 yards high	27 x 23ft	1	Flag floor and slated and sky-lighted roof
4	Stone building 1 st floor mechanics shop 2 nd floor joiners shop Attic pattern store	34 x 34ft	2 (plus attic)	Flag floor and slated and sky-lighted roof
4a	Lean-to extension to mechanics shop	34 x 8ft	1	Plank floor and glazed lean-to roof
4b	Engine house (stone built)	16 x 15ft	1	Flag floor and slated and sky-lighted roof
5	Copper roller house (stone built)	69 x 32ft	1	Flag floor and slated roof
6 & 7	Offices, store and engraving room (brick built)	37 x 22ft	Part 4 Part 3	Flag and wood floors, side windows, slated roof
8, 9, 10 & 11	Stone buildings housing roller stores, printing rooms and engraving room	86 x 34ft	Part 4 Part 3	Flag and boarded floor, side windows, internal division walls, slated roof
10a	Wooden gangway across yard	11 x 4ft		
11a	Brick-built shed over economisers	24 x 8ft	1	Blue slated roof
11b	Rag store (brick and corrugated iron built)	25 x 24ft		Two glazed windows with sliding door to yard
12	Brick-built boiler house	23 x 19ft	1	Open front wood shed to firing place with corrugated iron roof.
13 & 14	Brick building 1 st floor lofty washing place and boiler room 2 nd floor drying room	32 x 32ft	2	Equal to three storeys, With flag, iron grating and wood floors, side windows and slated roof.

Plan No	Description	Size	Floors	Structure
15	Brick building 1 st floor machine room 2 nd floor drying room 3 rd floor drying room	76 x 32ft	3	Part basement under. Flag and wood floors, side windows and slated roof.
15a	Timber-built staircase			
16 & 17	Stone building 1 st floor washing place 2 nd floor print room 3 rd floor white room	49 x 18ft	3	Flag and wood floor, side windows and slated roof.
17				
18	Timber-built gangway forming white room	29 x 19ft		Blue slated and skylighted roof
18a	Stone-built engine house	36 x 14ft	1	Iron-plated floor, side windows and plastered walls
19	Stone building 1 st floor washing place 2 nd floor ammonia ageing room 3 rd floor white room	50 x 30ft	3	Flag and wood floor, side windows and slated roof
20	Stone-built dye house	42 x 72ft (average 51 x 52ft)	1 (lofty)	Flag floor, cast-iron pillars, with slated, skylighted and ventilated roof. Houses enclosed timber-built piece stage.
21	Stone and brick building 1 st floor drug and lumber store 2 nd floor stentering room 3 rd floor winding-on and sewing rooms	57 x 27ft	3	Flag and wood floors, side windows, and blue slated timber roof
22	Stone building 1 st floor engine house 2 nd floor roller store and piece room 3 rd floor white room	90 x 30ft	3	Flag and boarded floor, side windows, and blue slated roof
22a	Stone building with first storey over river, and second storey forming a lofty hanging room.	46 x 26ft	2	Wood floors and slated timber roof
23	Brick and stone building 1 st floor cylinder drying room 2 nd floor plaiting down room	66 x 27ft	2	Flag and boarded floors and slated roof

Plan No	Description	Size	Floors	Structure
24	Stone-built drug store	31 x 19ft	1	Flag floor and skylighted and slated roof
25	Brick building Basement soap and drug store 1 st floor hanging and store room 2 nd floor hanging and store room 3 rd floor print room	106 x 37ft	3 (with cellar)	Flag and boarded floor, side windows, wood stairs and incline, Slated timber roof. Range of five brick-built closets, and range of eight new brick-built closets.
28a	Brick-built washing shed	14 x 10ft	1	Wood floor
30	Brick-built extension to print shop (not shown on 1909 Plan)	22 x 15ft		Wood floor and skylighted roof
32	Brick-built store room	14 x 10ft	1	Slated roof
33 & 34	Stone building 1 st floor washing and chemicing room 2 nd floor machine room 3 rd floor drying rooms	102 x 27ft	3	Flag and boarded floors, side windows and slated roof
35	Stone building 1 st floor open passage 2 nd floor sample room 3 rd floor white room	52 x 13ft	3	Paved sett floor to passage, wood floors to second and third floors, side widows and slated and skylighted roof.
36, 38, 39, 40, 41 & 47	Range of stone buildings 1 st floor oil store, rope race 2 nd floor finishing room 3 rd floor piece rooms	65 x 39ft	Part 3 Part 2	Flag and boarded floors, side windows, internal walls and slated roof
37	Bleach croft (stone built) Single-storey portion	44 x 18ft	1	Flag floor and slated and glazed roof
37	Bleach croft (stone built) Two-storey portion 1 st floor bleach croft 2 nd floor cylinder drying room	45 x 23ft	2	Flag and boarded floor and slated and skylighted roof
42	Brick and stone building 1 st floor open to croft and liquor store room 2 nd floor cylinder drying	42 x 13ft	2	Flag and wood floors, iron pillar and beam supports and slated roof
43	Stone building 1 st floor lofty cylinder drying room 2 nd floor piece room	47 x 38ft	2	Flag and wood floor, side windows and slated roof

Plan No	Description	Size	Floors	Structure
43a	Fancy dye house (stone built)	51 x 38ft	1	Flag floor, side windows, sky-lighted roof with enclosed stage
43d	Open liquor shed (timber built)	17 x 14ft	1	
44	High pressure kier house (stone built)	32 x 22ft	1	Slated and skylighted roof
44a	Lean-to shed (timber built)	16 x 10ft	1	
45	Brick building 1 st floor kier place 2 nd floor print room	61 x 23ft	2	
46	Brick building 1 st floor bleach croft 2 nd floor cylinder drying room	43 x 31ft	2	Flag and boarded floors, slated and sky-lighted roof
46a	Preparing room (timber built)	83 x 21ft	1	Slated roof and wood floor
46b	Piece room (timber built)	43 x 12ft	1	Wood floor
47	Timber-built 4 th storey to Building Range 36 etc used as plaiting room	39 x 18ft		Blue slated and skylighted timber roof
48	Brick and stone building 1 st floor part croft etc 2 nd floor part preparing 3 rd floor plaiting room	47 x 23ft	3	Flag and boarded floors
48a	Tentering house (galvanized and timber built)	130 x 16ft	1	Flag floor
49	Stone building 1 st floor calendaring room 2 nd floor plaiting down 3 rd floor gas singeing	26 x 25ft	3	Flag and boarded floors, slated and ventilated roof
50	Stone building 1 st floor pump house 2 nd floor piece room 3 rd floor rag store	24 x 15ft	3	Flag and boarded floors, slated roof
51	Stone building 1 st floor boiler house 2 nd floor unoccupied 3 rd floor loading etc	91 x 22ft	3	Boarded floors to second and third storeys, and grey slated timber roof
51a	Overhead wagon shed (timber built)	53 x 14ft	1	Large pair of sliding wooden doors, supported on wrought-iron girders and stone pillars

Plan No	Description	Size	Floors	Structure
-	New economiser house (brick built)	31 x 17ft	1	
51b	Timber-built overhead gangway	29 x 6ft		Galvanised partition to hoist
52	Stone building 1 st storey boiler house 2 nd storey grey room	45 x 32ft	2	Boarded floor to second storey, grey slated and skylighted roof
53	Bale store and loading room (stone built)	33 x 28ft	1	Boarded floor, and grey slated and skylighted roof
53a	Liquor and cylinder store shed (galvanized and timber built)	36 x 32ft	1	Flag and plank floor
54				
54a	Stone building 1 st storey boiler house 2 nd storey cloth house	42 x 19ft	2	Boarded floor to second storey, slated and skylighted timber roof
-	Octagon stone-built chimney	28 yards high		
55 & 56	Economiser house and roof drying shed	27 x 23ft	1	Blue and grey slated roof
57 & 59	Roller etching shed (brick built)	24 x 23ft	1	Flag floor, side windows, slated and sky-lighted roof
58 & 63	Roller and mill turning and copper depositing rooms (brick built)	49 x 19ft	1	Flag floor, side windows, slated and sky-lighted roof
58a	Photographing room (timber built)	27 x 10ft	1	Wood floor, side windows and corrugated roof
58b	Brick-built camera room	28 x 11ft	1	Slated and boarded roof
59a	Engravers' office (over lodge)	16 x 13ft	1	Boarded floor over wrought-iron H girders.
59b	Brick-built acid shed	16 x 7ft	1	
60	Timber and brick buildings	21 x 12ft	1	Flag and boarded floor with slated roof
62	Timber-built order office	50 x 26ft	1	Blue slated roof on rolled steel girders and wood gangway

APPENDIX 3: LIST OF ENGLISH CALICO PRINTERS IN 1840

The following table of English calico printers in 1840 was copied from an original list and published in *The Textile Colourist* of April 1876 (reproduced in Turnbull 1951).

Name of Firm	Name of Works	Machines	Short Tables	Long Tables
Simpson, Rostron & Co	Foxhill Bank, Accrington	13	163	26
Hargreaves, Dugdale & Co	Broad Oak, Accrington	12	320	-
J Brooke	Sunny Side, Burnley	12	180	-
Coates & Heald	Strangeways, Manchester	12	153	
Wood & Wright	Bank Bridge, Manchester	11	105	-
J Marsland & Bros	Marsland, Stockport	10	146	-
Gisborne & Wilson	Adelphi, Salford	10	72	-
Sheriff, Foster, Gillet & Hindle	Sabden, Padiham	9	190	
T Hoyle & Son	Mayfield, Manchester	9	186	-
R Turner & Co	Mill Hill, Blackburn	9	184	-
Nuttall, Giles & Watchurst	Hampson Mill, Bury	8	111	-
Leese, Kershaw & Co	Ardwick Bridge, Manchester	8	63	-
J Thompson & Son	Primrose, Clitheroe	7	204	80
Fort & Co	Oakenshaw, Accrington	7	206	
Callender & Bickham	Bradshaw Hall, Bolton	7	192	-
Hardman & Price	Bury	7	176	-
Higgin, Darbyshire & Chippendall	Horwich Vale, Bolton	7	151	-
J & J Dugdale	Lower House, Padiham	7	140	-
S Schwabe & Co	Middleton	7	120	-
R Matley	Hodge Mill, Mottram	6	221	-
R & M Smith & Co	Baxendale, Accrington	6	172	-
Horrocks, Goodlad & Worthington	Mount Sion, Radcliffe	6	170	-
C Robinson	Strines Hall, Disley	6	143	-
W Grant & Bros	Ramsbottom, Bury	6	107	-
Hutchinson & Sons	Radcliffe	6	103	-
Margerisons & Glover	Burnley	6	102	21
R Cobden & Bros	Cross Hall, Chorley	5	175	7
R Peel & Co	Church Bank, Accrington	5	132	-
W Cowsill	Blackford Bridge, Bury	5	100	-
Burgess & Townsend	Stansfield Hall, Rochdale	5	96	-

Name of Firm	Name of Works	Machines	Short Tables	Long Tables
Nelson, Knowles & Co	Tottington Mill, Bury	5	95	-
O Hulme & Sons	Medlock Vale, Ashton	5	72	-
Hall & Gorton	Kirklees Mill, Bury	5	60	-
J Hudson & Co	Gale, Littleborough	5	82	-
T & J Dalton	Hollingworth Mill, Mottram	5	30	
Doody & Price	Cobhouse Nab, Bury	5	28	-
Ainsworth & Sykes	Broughton Bridge, Salford	5	17	-
J & R Ashton	Hyde	5	16	-
Wilson & Co	Levenshulme, Manchester	5	-	-
Becker Bros & Co	Reddish Mills, Stockport	4	116	2
Bayley & Keeling	London Place, Manchester	4	140	-
J Wright & W Aylmer	Brinscall, Chorley	4	120	-
E Potter	Dinting Vale, Glossop	4	117	-
J Andrew	Dainwater, New Mills	4	116	-
Reddish, Bickham & Co	Brookside, Blackburn	4	114	-
J Bennett	Hayfield, Glossop	4	103	-
Swanwick & Johnson	Hollins Vale, Bury	4	96	-
J Grimshaw	Plantation Mills, Accrington	4	80	-
J Lowe & Co	Shepley Vale, Ashton	4	79	-
Potter & Ross	Darwen	4	75	-
G & J Billington	Quarlton Vale, Bolton	4	71	-
W Benecke & Co	Bellfield Hall, Rochdale	4	66	-
W Sudren	Bolholt, Bury	4	60	-
Coates & Heald	Seedly, Salford	4	61	-
Fielding & Rowbottom	Bowker Bank, Manchester	4	57	-
Brown & Powell	Spring Vale, Stockport	4	40	-
Jackson, Watson & Greig	Rose Bank, Bury	4	29	2 flat presses
J Gallemore	Ancoats, Manchester	4	-	-
Loyd, Buchan & Welsh	Furness, Disley	3	93	-
Cooke & Unsworth	Love Clough, Burnley	3	86	-
Brown & Powell	Stubbins, Bury	3	84	-
G & S Potter	Birkacre, Chorley	3	75	-
West & Winder	Belmont	3	70	-
Wilson & Crighton	Blackley, Manchester	3	60	-
Coston & Lycett	Agecroft Bridge, Manchester	3	45	-
C Neville	Harpurhey, Manchester	3	42	-

Name of Firm	Name of Works	Machines	Short Tables	Long Tables
J Barge	Broughton Bridge, Salford	3	40	-
Roxburg & Ashworth	Know Mill, Bolton	3	40	-
Downes & Furnough	Cheadle Vale, Cheadle	3	39	-
Ainsworth, Sykes & Co	Barrow, Clitheroe	3	35	-
Ingham & Yates	London Place, Hayfield	3	34	-
Sydall & Addison	Chadkirk, Stockport	3	9	-
Thomas Duckworth	Cheadle Grove, Cheadle	2	22	2
Smith & Lockett	Rockliffe Vale, Bacup	2	14	32
A Thomas & Co	Spring Water, Radcliffe	2	129	-
J Greaves	Turton Mill, Bolton	2	80	-
Burford & Kay	Trub Smithy, Manchester	2	58	-
C Swainson & Son	Bannister Hall, Chorley	2	53	-
J Aderton	Tootal Bridge, Bolton	2	50	-
E Lucas	Wood Print Works, Hayfield	2	48	-
G Andrew & Sons	Compstall, New Mills	2	37	-
F Steiner	Church Bank, Accrington	2	36	-
G Rendrick Gill	Low Mill, Bolton	2	36	-
L Short	Wood End, Disley	2	34	-
J Roberts & Co	Prestolee, Bolton	2	32	-
Sandiford, Moon & Layton	Kem Mill, Chorley	2	29	-
J Wardley	Spring Vale, Darwen	2	20	-
J & C Yates	Rock Mill, Disley	2	16	-
Wm Shepherd & Co	Carbrook, Stalybridge	2	-	-
R Holden	Denham Springs, Chorley	1	40	-
Hamer, Clough, Smith & Holgate	Irwell, Rochdale	1	40	-
W Yates	Waterhouses, Blackrod	1	32	-
T Bentley	Eccleston, Chorley	1	30	-
H Crompton	Tootal Vale, Bolton	-	18	-
J Scholes	Junction, Saddleworth	Not at Work		
C Palfreyman	Wild Boar Clough, Macclesfield	Not at Work		
TOTALS	94 (Details Given)	435	8129	168

List of calico printers in England in 1840

Name of Firm	Name of Works	Machines	Short Tables	Long Tables
Hardman & Price	Bury	7	176	-
Horrocks, Goodlad & Worthington	Mount Sion, Radcliffe	6	170	-
A Thomas & Co	Spring Water, Radcliffe	2	129	-
Nuttall, Giles & Watchurst	Hampson Mill, Bury	8	111	-
W Grant & Bros	Ramsbottom, Bury	6	107	-
Hutchinson & Sons	Radcliffe	6	103	-
W Cowsill	Blackford Bridge, Bury	5	100	-
Swanwick & Johnson	Hollins Vale, Bury	4	96	-
Nelson, Knowles & Co	Tottington Mill, Bury	5	95	-
Brown & Powell	Stubbins, Bury	3	84	-
Hall & Gorton	Kirklees Mill, Bury	5	60	-
W Sudren	Bolholt, Bury	4	60	-
Jackson, Watson & Greig	Rose Bank, Bury	4	29	2 flat presses
Doody & Price	Cobhouse Nab, Bury	5	28	-

List of calico printers within the boundary of the modern borough of Bury in 1840

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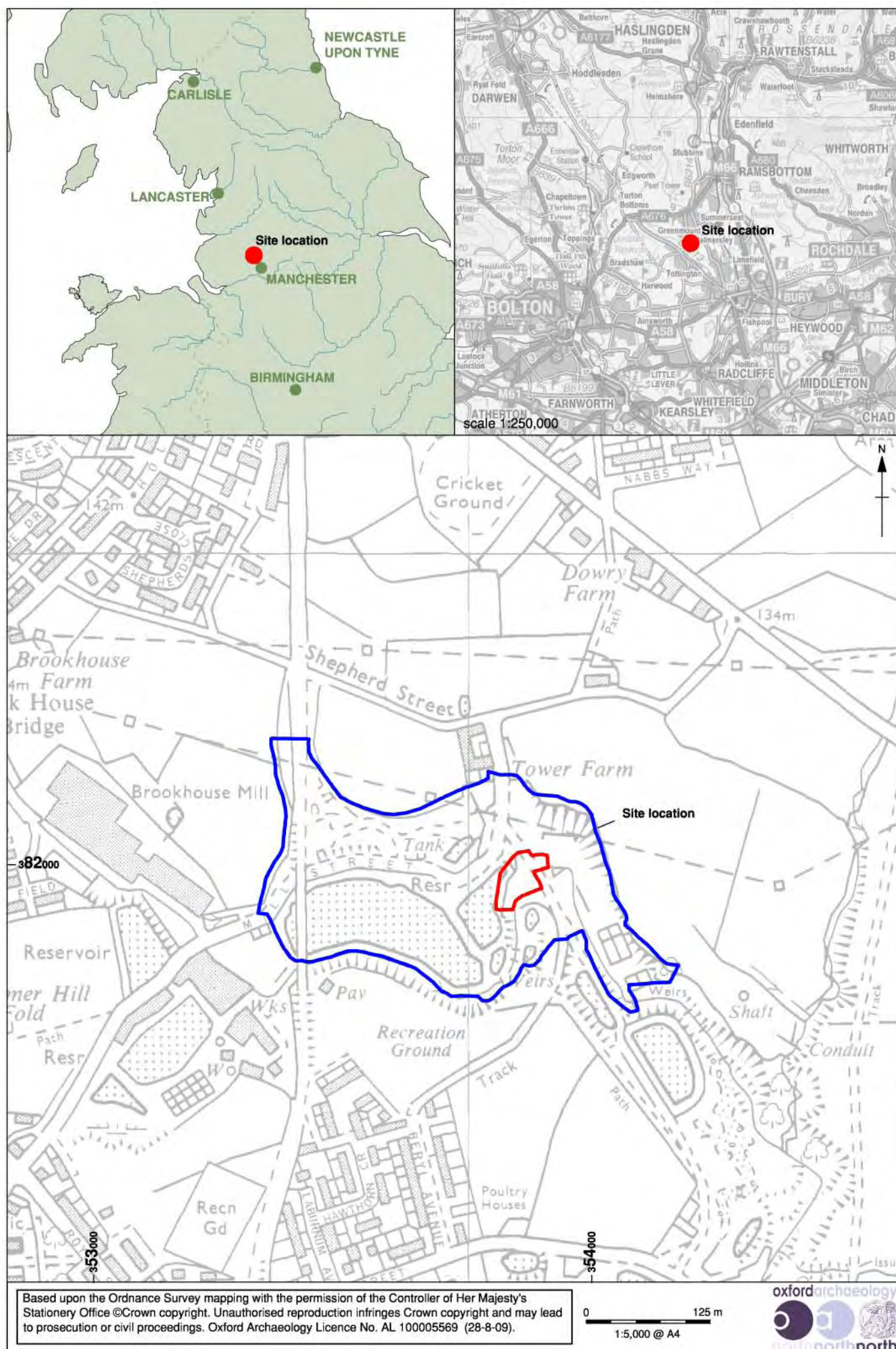


Figure 1: Site location

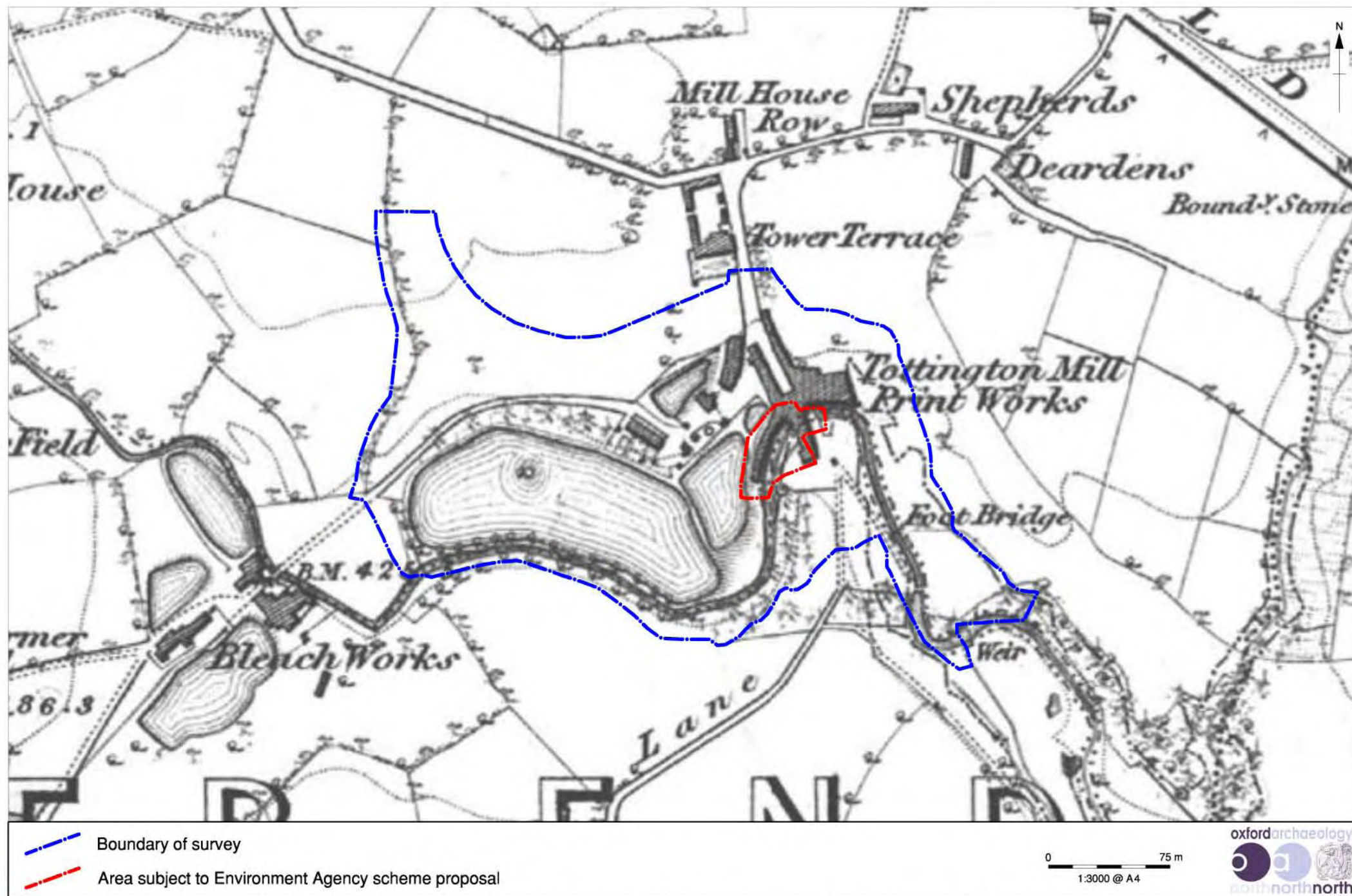


Figure 2: Extract from the Ordnance Survey first edition 6" to 1 mile map of 1848

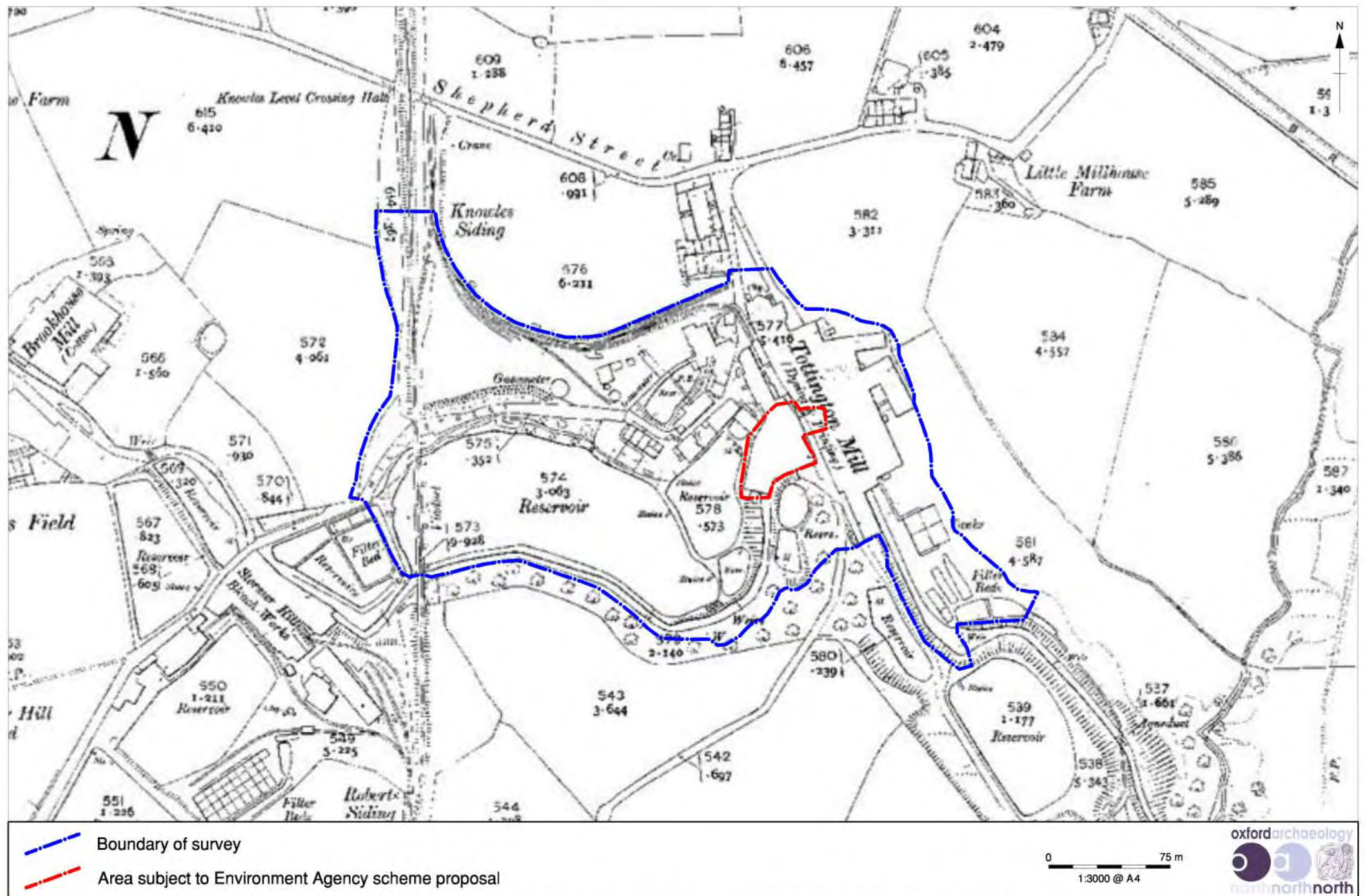


Figure 4: Extract from the Ordnance Survey second edition 25" to 1 mile map of 1907

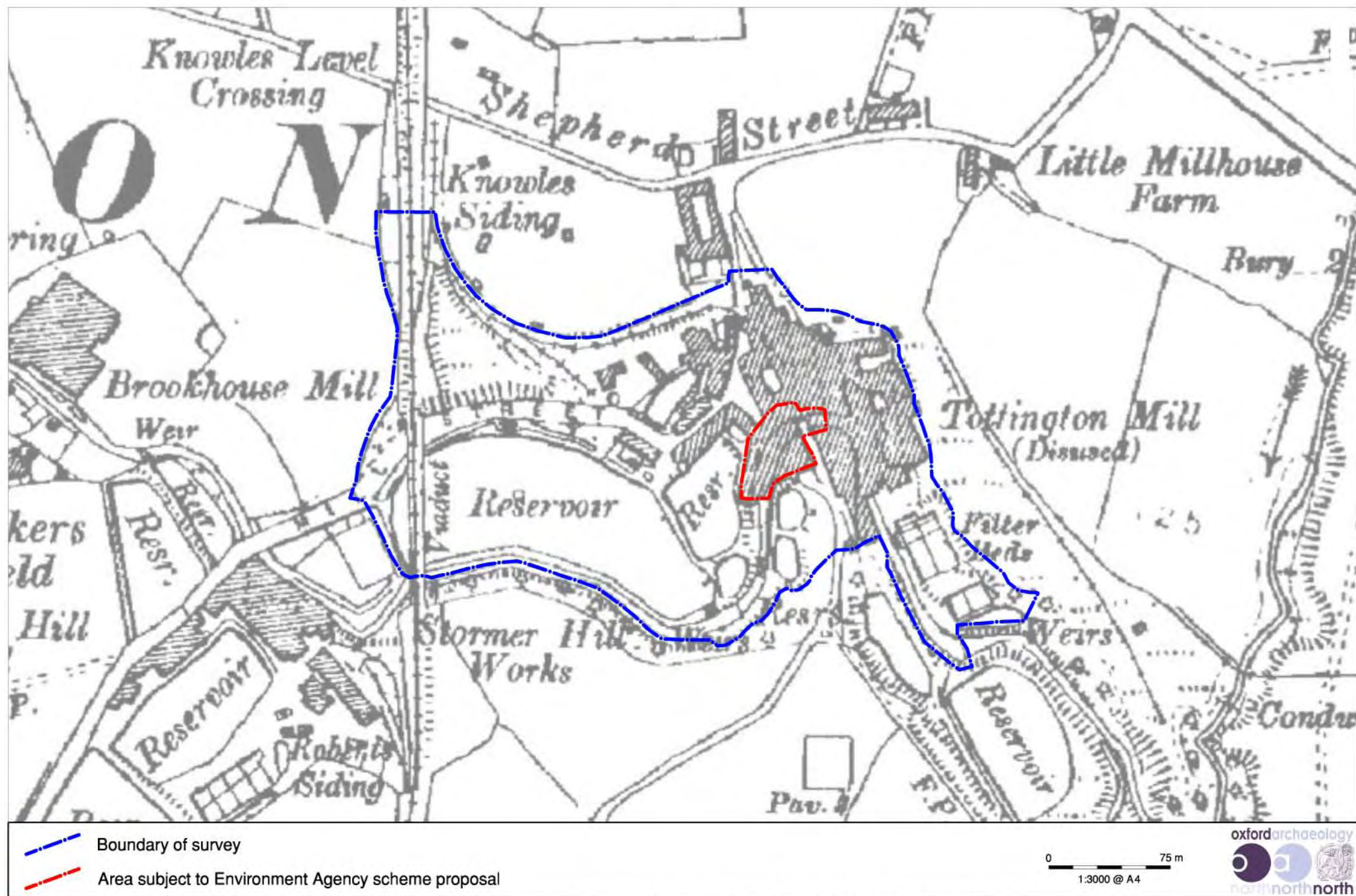
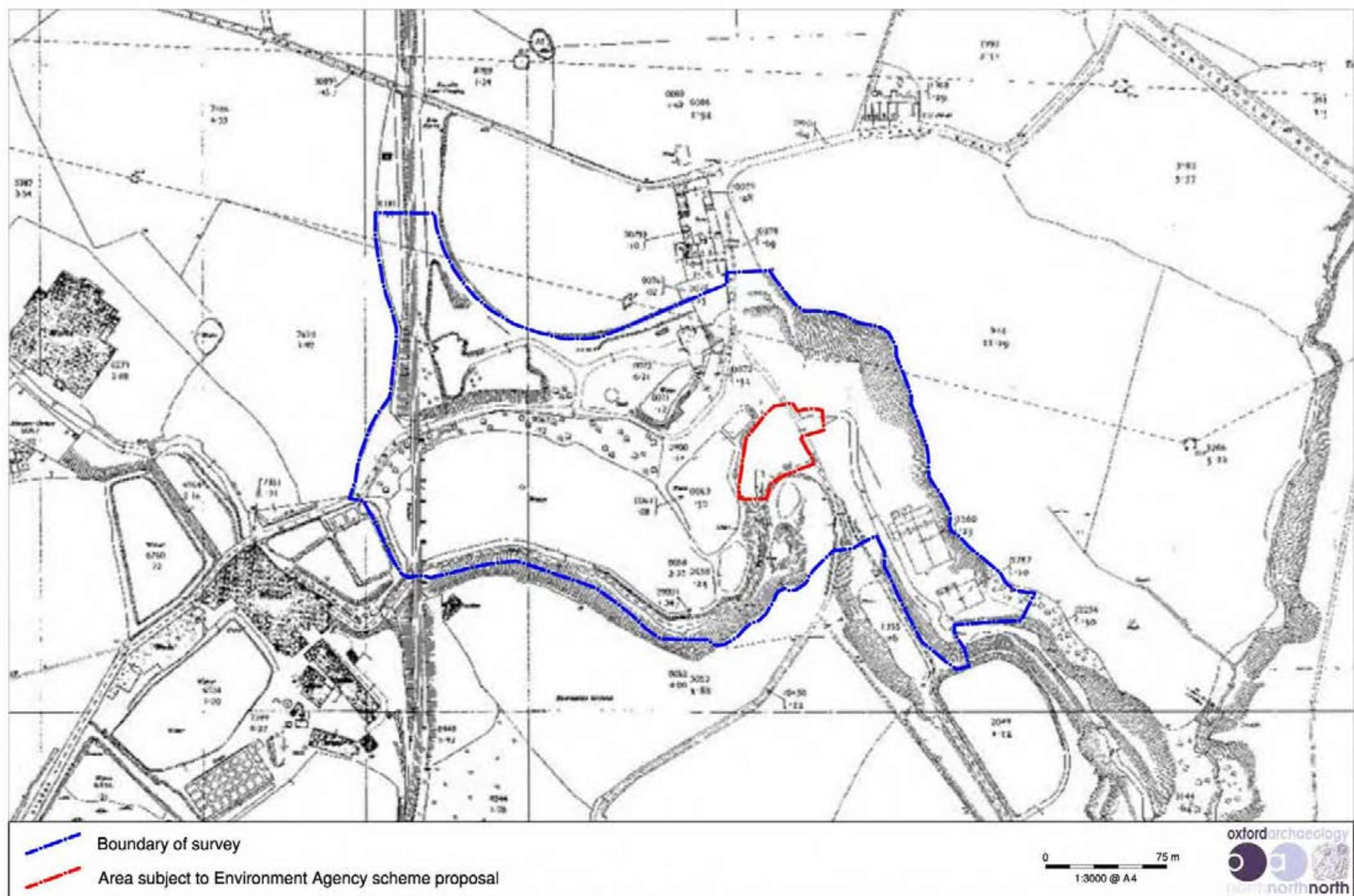


Figure 5: Extract from the Ordnance Survey third edition 25" to 1 mile map of 1923



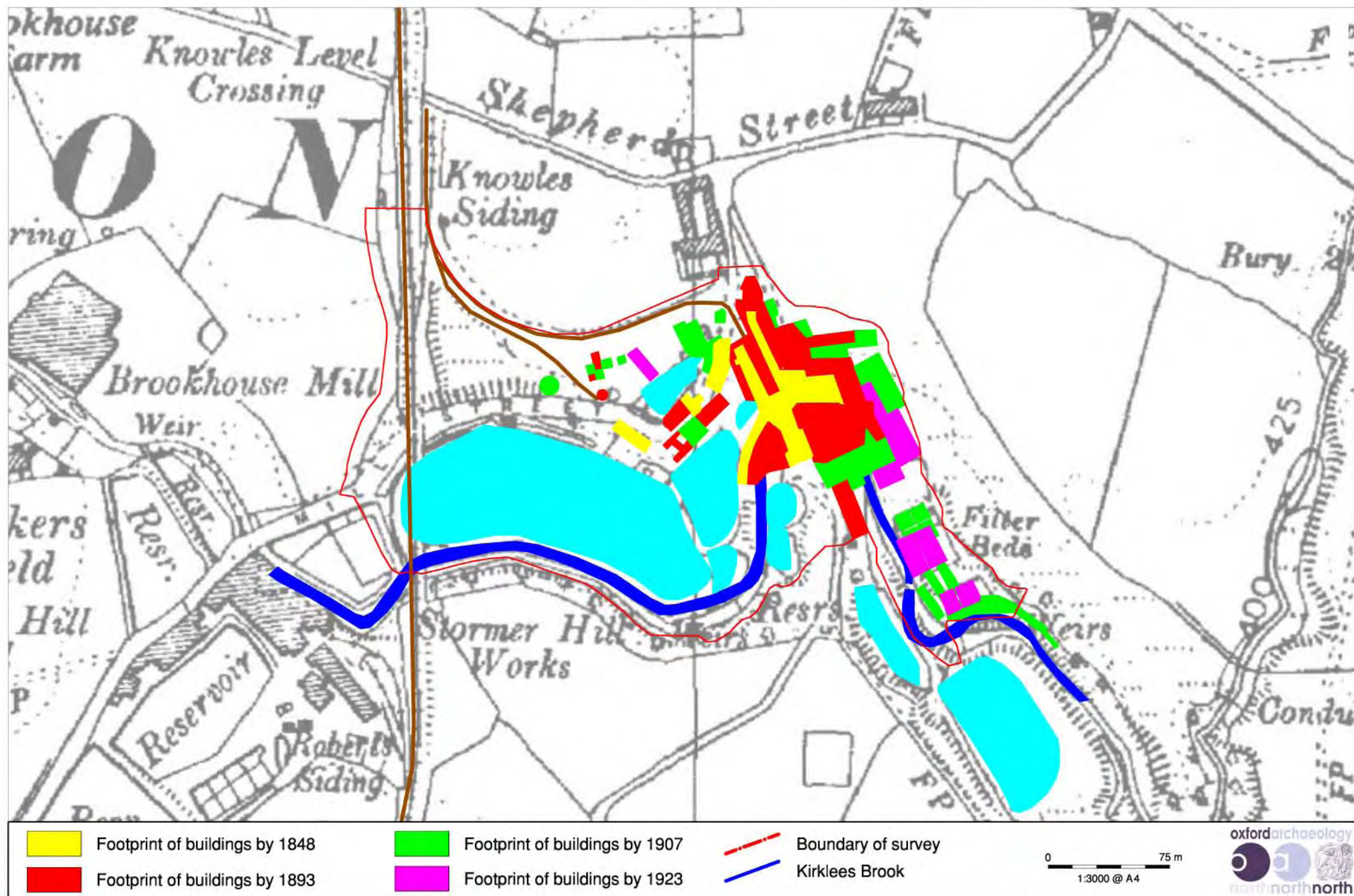


Figure 7: Block plan showing phased development of the print works, superimposed on the Ordnance Survey map of 1954

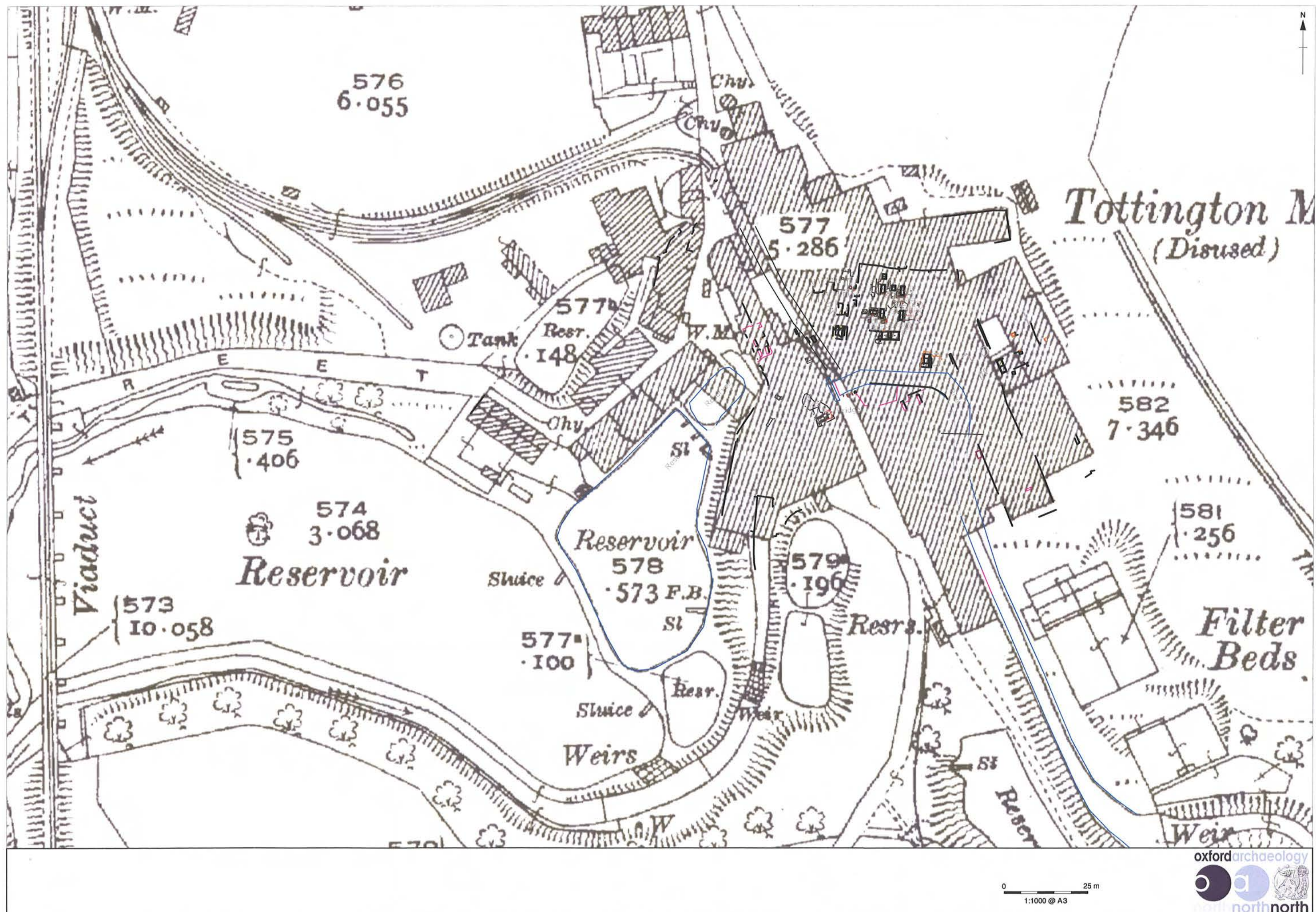


Figure 8: Location of the surveyed remains, superimposed on the Ordnance Survey map of 1930



Figure 9: Location of the excavation areas and surveyed remains, superimposed on the Valuation and Inventory Plan of 1904



Figure 10: Plan of the excavated remains exposed in the Bleach Croft

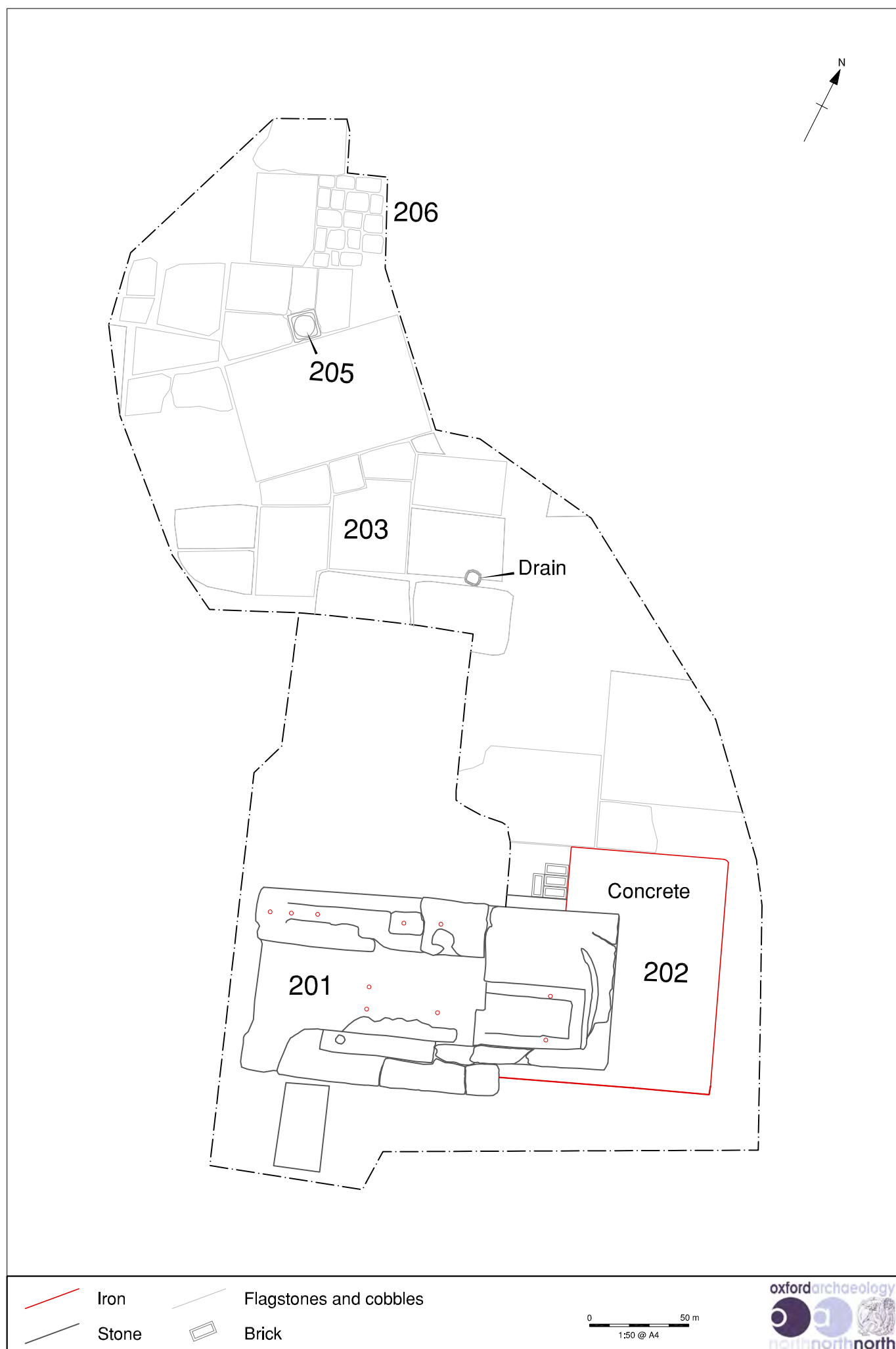


Figure 11: Plan of the excavated remains exposed in the Dye House